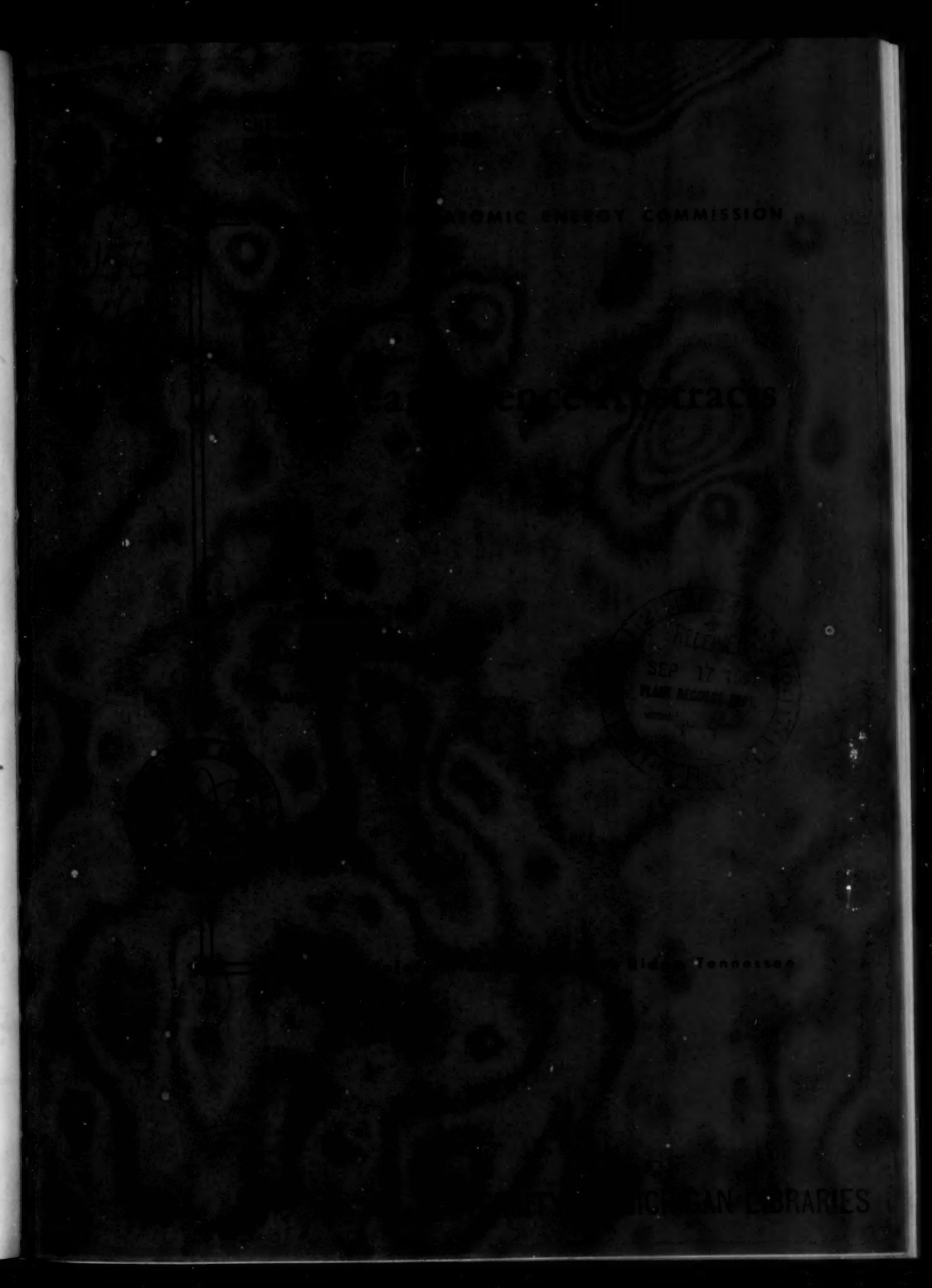

ATOMIC ENERGY COMMISSION
SEP 17
Tennessee

NUCLEAR SCIENCE ABSTRACTS

Nuclear Science Abstracts is issued twice monthly throughout the calendar year by the Atomic Energy Commission. It is intended primarily to serve scientists and engineers working within the Atomic Energy Project by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only the unclassified and declassified research reports of the Atomic Energy Commission and its contractors, but also material in its field of interest which appears in government and scientific journals and unpublished research reports of governmental agencies, universities, and industrial research establishments.

INDEXES

Volumes 1, 2, 3, and 4 of Nuclear Science Abstracts are cumulatively indexed by Author, Subject, and Nuclide in Volume 4, No. 24B, Dec. 30, 1950. The Author, Subject, and Nuclide indexes for Volume 5 of NSA appear in Volume 5, No. 24, Dec. 31, 1951. The cumulative Numerical Index of AEC Reports, described on the inside back cover, is published in Volume 5, No. 24, and includes all reports abstracted in the first five volumes of Nuclear Science Abstracts as well as those abstracted in Abstracts of Declassified Documents.

Each issue of Volume 6(1952) contained an Author Index and a current supplement to the cumulative Numerical Index of Reports. Subject and Author Indexes, published quarterly, are issued as separate supplements to the sixth, twelfth, and eighteenth issues. The 24th issue will be the Cumulative Index for the year.

AVAILABILITY

Nuclear Science Abstracts is available on a subscription basis at six dollars ($6.00) a year domestic and ($9.00) foreign from

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Nuclear Science Abstracts is also available on an exchange basis to universities, learned societies, research institutions, industrial firms, and publishers of scientific information. The Atomic Energy Commission invites correspondence from such organizations looking toward the exchange of publications. Inquiries regarding such exchanges and other official distribution as well as notices of address changes should be sent to:

Technical Information Service
U. S. Atomic Energy Commission
P. O. Box 62
Oak Ridge, Tennessee

For information on obtaining AEC nonclassified research reports see the inside back cover.

Listing of these Abstracts does not constitute authority for declassification of any reports.

PRINTED IN U.S.A.
PRICE 35 CENTS

The printing of this publication has been approved by the Director of the Bureau of the Budget, August 2, 1951.

Chemistry Library
QC
770
.U56
v.6
no.16

NUCLEAR SCIENCE ABSTRACTS

Vol. 6, No. 16, August 31, 1952

TABLE OF CONTENTS

Category	Abstract	Page
REPORTS REFERENCE LIST		iii
GENERAL	4681	573
Atomic Power	4681	
BIOLOGY AND MEDICINE	4682	573
Radiation Effects	4684	
Radiation Hazards and Protection	4709	
Radiotherapy	4712	
Toxicology Studies	4714	
Tracer Applications	4716	
CHEMISTRY	4724	580
Analytical Procedures	4730	
Atomic Weights and Periodic Systems	4737	
Crystallography and Crystal Structure	4738	
Deuterium and Deuterium Compounds	4739	
Fluorine and Fluorine Compounds	4744	
Graphite	4745	
Molecular Structure	4746	
Radiation Effects	4748	
Separation Procedures	4751	
Spectroscopy	4754	
Syntheses	4758	
Transuranic Elements and Compounds	4762	
Uranium and Uranium Compounds	4763	
Waste Disposal	4764	
ENGINEERING	4766	584
Heat Transfer and Fluid Flow	4766	
Materials Testing	4771	
Radiography	4772	
Vacuum Systems	4773	
MINERALOGY, METALLURGY, AND CERAMICS	4774	586
Ceramics and Refractories	4774	
Corrosion	4776	
MINERALOGY, METALLURGY, AND CERAMICS		
Geology and Mineralogy	4778	
Metals and Metallurgy	4780	
PHYSICS	4800	589
Aerosols	4810	
Cosmic Radiation	4813	
Electrical Discharge	4843	
Electrons	4844	
Gases	4847	
Instruments	4849	
Isotopes	4859	
Isotope Separation	4861	
Mass Spectrography	4862	
Measuring Instruments and Techniques	4866	
Mesons	4895	
Meteorology	4912	
Molecular Properties	4913	
Neutrons	4915	
Nuclear Physics	4918	
Nuclear Properties	4924	
Nuclear Reactors	4938	
Nuclear Transformation	4941	
Particle Accelerators	4959	
Radiation Absorption and Scattering	4964	
Radiation Effects	4978	
Radioactivity	4982	
Rare Earths and Rare-earth Compounds	4993	
Spectroscopy	4994	
Theoretical Physics	4995	
Tracer Applications	5006	
AUTHOR INDEX		INDEX-1
NUMERICAL INDEX OF REPORTS		INDEX-5
NEW NUCLEAR DATA		SUPPLEMENT-1

REPORTS REFERENCE LIST

Vol. 6, No. 16

The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

U. S. ATOMIC ENERGY COMMISSION DECLASSIFIED REPORTS

AECD-1945(Rev.) 4866
Argonne National Lab.
STUDIES WITH THE RANGER, by D. L. Hill. Apr. 14, 1947. Decl. May 7, 1948 and Dec. 5, 1951. 84p. (AECD-1945 (Rev.); AECD-3281; CP-3800)

AECD-3412 4763
Carbide and Carbon Chemicals Co. (K-25)
SOLUBILITY OF URANIUM TETRAFLUORIDE IN WATER, by H. A. Bernhardt, J. H. Junkins and S. S. Kirslis. Issued June 15, 1949. Decl. with deletions June 30, 1952. 11p. (AECD-3412; K-422)

AECD-3413 4915
Oak Ridge National Lab.
A DIFFUSION SOLUTION FOR THE CYLINDRICAL DUCTING PROBLEM OF INFINITE GEOMETRY, by David W. Whitcombe. Issued Apr. 19, 1950. Decl. June 30, 1952. 14p. (AECD-3413; ORNL-668; NEPA-1363)

AECD-3414 4981
Argonne National Lab.
RADIATIONS OF 6.7d U^{237}, by F. Wagner, Jr., M. S. Freedman, D. W. Engelkemeir, and J. R. Huizenga. May 14, 1952. Decl. June 30, 1952. 16p. (AECD-3414; ANL-OCS-275)

AECD-3415 4938
Argonne National Lab.
THE ARGONNE HEAVY WATER REACTOR (CP-3 PRIME), by [W. H. Zinn]. Aug. 10, 1951. Decl. with deletions July 9, 1952. 40p. (AECD-3415; ANL-WHZ-311)

AECD-3416 4751
Oak Ridge National Lab.
THE DETERMINATION OF OXYGEN IN SODIUM, by J. C. White, W. J. Ross, and R. Rowan, Jr. Apr. 30, 1952. Decl. July 10, 1952. 26p. (AECD-3416; ORNL-1286)

U. S. ATOMIC ENERGY COMMISSION UNCLASSIFIED REPORTS

AECU-2082 4724
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
REPORT OF PROGRESS AND EXPENDITURES JULY 1, 1951 TO JUNE 30, 1952 AND PROPOSALS FOR THE COMING FISCAL YEAR. [nd] 71p. (AECU-2082)

AECU-2088 4780
Institute of Engineering Research, Univ. of Calif.
FUNDAMENTALS OF GLASS TO METAL BONDING. II. WETTABILITY OF SOME GROUP I AND VIII METALS BY SEVERAL SODIUM SILICATE GLASSES; SECOND TECHNICAL REPORT, by Victor F. Zackay, David W. Mitchell, Stephan P. Mitoff and Joseph A. Pask. Apr. 15, 1952. 27p. (AECU-2088)

AECU-2093 4810
Illinois Univ.
SOME ASPECTS OF THE PHYSICAL BEHAVIOR OF AEROSOL PARTICLES IN THE ATMOSPHERE, by W. E. Ranz and H. F. Johnstone. May 5, 1952. 18p. (AECU-2093)

AECU-2094 4800
Pennsylvania Univ.
ANNUAL REPORT; PHYSICS OF METALS AND ALLOYS AT LOW TEMPERATURES. July 1, 1951. 39p. (AECU-2094)

AECU-2095 4709
Los Alamos Scientific Lab.
STRAIN SPECIFICITY OF THE THERAPEUTIC EFFECT OF SPLENIC TRANSPLANTS IN IRRADIATED MICE, by John B. Storer. [nd] 15p. (AECU-2095; LADC-1196)

AECU-2096 4716
Michigan State Coll.
THE METABOLISM OF FOLIAR APPLIED UREA. I. RELATIVE RATES OF $C^{14}O_2$ PRODUCTION BY CERTAIN VEGETABLE PLANTS TREATED WITH LABELED UREA, by O. N. Hinsvark, S. H. Wittwer, and H. B. Tukey. [nd] 13p. (AECU-2096)

AECU-2097 4717
Michigan State Coll.
ABSORPTION OF NUTRIENTS BY STEMS AND BRANCHES OF WOODY PLANTS, by H. B. Tukey, R. L. Ticknor, O. N. Hinsvark and S. H. Wittwer. [nd] 6p. (AECU-2097)

AECU-2098 4710
Los Alamos Scientific Lab.
LACK OF EFFECT OF URINARY EXTRACTS FROM IRRADIATED SPLEEN-SHIELDED RATS ON SURVIVAL OF IRRADIATED MICE, by J. B. Storer, and J. E. Furchner. [nd] 8p. (AECU-2098; LADC-1195)

AECU-2099 4712
California Univ., School of Medicine
DEFINITIVE THERAPY OF HYPERTHYROIDISM WITH IODINE 131, by Earl R. Miller. June 9, 1952. 5p. (AECU-2099)

AECU-2100 4684
Notre Dame Univ.
TEMPERATURE EFFECT ON IRRADIATION DAMAGE IN BACTERIOPHAGE, by C. S. Bachofer. [nd] 2p. (AECU-2100)

AECU-2101 4685
Notre Dame Univ.
DIRECT EFFECT OF X-RAYS ON BACTERIAL VIRUSES MODIFIED BY PHYSICAL STATE AND RELATED TO THE TARGET THEORY, by C. S. Bachofer. [nd] 11p. (AECU-2101)

AECU-2102 4686
Notre Dame Univ.
PROTECTION OF BACTERIOPHAGE AGAINST X-RAYS BY HIGH CONCENTRATIONS OF A NEUTRAL SALT, by C. S. Bachofer and M. Aelred Pottinger. [nd] 25p. (AECU-2102)

AECU-2103 4730
Argonne National Lab.
DETERMINATION OF THALLIUM BY RADIOACTIVATION;

APPLICATION TO POTASSIUM IODIDE, by C. J. Delbecq, L. E. Glendenin, and P. H. Yuster. June 25, 1952. 12p. (AECU-2103; UAC-592)

AECU-2104 4941
Argonne National Lab.
THE REACTION $Li^6(\gamma,d)He^4$ AT 2.76 MEV, by Howard B. Glenn. June 23, 1952. 3p. (AECU-2104; UAC-590)

AECU-2105 4731
Argonne National Lab.
A MICROMETHOD FOR THE SIMULTANEOUS DETERMINATION OF TOTAL CARBON AND CARBON 14, by P. V. Harper and K. A. Lathrop. Argonne National Lab. and Univ. of Chicago. Apr. 1952. 8p. (AECU-2105; UAC-584)

AECU-2106 4849
Argonne National Lab.
A MERCURY PISTON GAS PUMP, by Donald L. Buchanan. June 1952. 8p. (AECU-2106; UAC-583)

AECU-2107 4982
Argonne National Lab.
HALF-LIVES OF Eu^{152}, Eu^{154} AND Sm^{151}, by D. G. Karraker, R. J. Hayden, and M. G. Inghram. June 1952. 2p. (AECU-2107; UAC-591)

AECU-2108 4718
Oregon Univ. Medical School
TIME COURSE OF LIPIDE LABELING IN THE INTACT MOUSE AND RAT, by J. T. Van Bruggen, T. T. Hutchens, C. K. Claycomb, and Edward S. West. [nd] 16p. (AECU-2108)

AECU-2109 4687
Argonne National Lab.
BIOLOGIC AND PHYSICAL ASPECTS OF THE ACTION OF TWO RADIATIONS OF DIFFERENT SPECIFIC IONIZATION, By Joanne W. Hollcroft and Egon Lorenz. National Cancer Inst. and Argonne National Lab. May 1952. 26p. (AECU-2109; UAC-580)

AECU-2110 4725
Argonne National Lab.
ELECTROLYTIC REDUCTION OF PERRHENATE. II. STUDIES IN SULFURIC ACID, by Philip Wehner and J. C. Hindman. June 1952. 21p. (AECU-2110; UAC-579)

AECU-2111 4714
Argonne National Lab.
THE EFFECT OF ADRENOCORTICOTROPHIC HORMONE ON TISSUE DISTRIBUTION AND TOXICITY OF BERYLLIUM, by M. R. White, A. J. Finkel, and J. Schubert. May 1952. 5p. (AECU-2111; UAC-578)

AECU-2112 4726
Argonne National Lab.
ELECTROLYTIC REDUCTION OF PERRHENATE. I. STUDIES IN PERCHLORIC, ETHANESULFONIC, TRIFLUORACETIC AND HYDROCHLORIC ACIDS, by J. C. Hindman and Philip Wehner. May 1952. 20p. (AECU-2112; UAC-577)

AECU-2113 4732
Argonne National Lab.
A METHOD FOR THE DETERMINATION OF CALCIUM 40 AND CALCIUM 45 IN BIOLOGICAL MATERIAL, by William P. Norris and Blanche J. Lawrence. June 1952. 10p. (AECU-2113; UAC-593)

AECU-2114 4711
New York Univ.
STUDIES OF THORIUM X APPLIED TO HUMAN SKIN. II. COMPARATIVE FINDINGS OF THE PENETRATION AND LOCALIZATION OF THORIUM X WHEN APPLIED IN ALCOHOLIC SOLUTION, IN OINTMENT AND IN LACQUER VEHICLES, by Victor H. Witten, Milton S. Ross, Eleanor Oshry, and Vera Holmstrom. [nd] 22p. (AECU-2114)

AECU-2115 4924
Purdue Univ.
THE ANGULAR CORRELATION OF THE GAMMA RAYS EMITTED FROM THE EXCITED STATES OF Cd^{114} (abstract), by Rolf M. Steffen and W. Zobel. [nd] 1p. (AECU-2115)

AECU-2116 4850
Notre Dame Univ.
A DEVICE FOR HIGH-INTENSITY, VACUUM-IRRADIATION OF SMALL SAMPLES AT CONTROLLED TEMPERATURES, by C. S. Bachofer. [nd] 6p. (AECU-2116)

AECU-2117 4766
Iowa State Univ. Graduate Coll.
THE SEPARATION OF GASES BY MEANS OF POROUS MEMBRANES (thesis), by Howard E. Huckins, Jr. and Karl Kammermeyer. Aug. 1951. 53p. (AECU-2117)

AECU-2118 4978
Illinois Univ.
PROGRESS REPORT [ON] RADIATION DAMAGE AND RECOVERY IN Cu, Ag, Au, Ni, AND Ta, by J. W. Marx, H. G. Cooper and J. W. Henderson. July 1, 1952. 33p. (AECU-2118)

AECU-2119 4942
Los Alamos Scientific Lab.
COULOMB FUNCTIONS FOR HEAVY NUCLEAR PARTICLES, by W. D. Barfield and A. A. Broyles. [nd] 2p. (AECU-2119; LADC-1206)

AECU-2120 4862
Argonne National Lab.
MASS SPECTROSCOPY, by Mark G. Inghram and Richard J. Hayden. Argonne National Lab. and Univ. of Chicago. Apr. 4, 1952. 144p. (AECU-2120; UAC-582)

AECU-2121 4851
Los Alamos Scientific Lab.
A SINGLE-CRYSTAL MICRO-BEAM X-RAY GONIOMETER, by Joseph Singer, John A. Richards, and William C. Moxley. [nd] 8p. (AECU-2121; LADC-1207)

AECU-2122 4964
Los Alamos Scientific Lab.
ELASTIC SCATTERING OF PROTONS AND NEUTRONS BY HELIUM, by D. C. Dodder and J. L. Gammel. [nd] 23p. (AECU-2122; LADC-1205)

ANL-4519 4776
Argonne National Lab.
WATER CORROSION OF STRUCTURAL MATERIALS; OCTOBER, 1948–JUNE, 1951, by C. R. Breden, S. Greenberg, R. M. Robinson, A. H. Roebuck, V. F. Saitta and C. C. Scott. July 15, 1951. 198p. (ANL-4519)

ANL-4745 4688
Argonne National Lab.
DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 132p. (ANL-4745)

ANL-4745(p.14-42) 4689
Argonne National Lab.
CHRONIC EXTERNAL IRRADIATION AND NEUTRON RADIOBIOLOGY, p.14-42 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 29p. (ANL-4745(p.14-42))

ANL-4745(p.43-52) 4690
Argonne National Lab.
PHYSIOLOGY, RADIUM TOXICOLOGY, AND EXPERIMENTAL PATHOLOGY, p.43-52 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 10p. (ANL-4745(43-52))

ANL-4745(p.53-70) 4691
Argonne National Lab.
EXPERIMENTAL SURGERY, CLINICAL INVESTIGATION, AND RADIOCHEMISTRY, p.53-70 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 18p. (ANL-4745(53-70))

ANL-4745(p.73-93) 4692
Argonne National Lab.
SPECIAL PROBLEMS, PLANT PHYSIOLOGY, MICROBIOLOGY, AND BIOCHEMISTRY, p.73-93 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 21p. (ANL-4745(p.73-93))

ANL-4745(p.94-126) 4693
Argonne National Lab.
PHYSIOLOGICAL CHEMISTRY, PHYSICAL CHEMISTRY, PHARMACOLOGY, THEORETICAL BIOLOGY, AND BIOPHYSICS, p.94-126 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 33p. (ANL-4745(p.94-126))

BMI-748 4774
Battelle Memorial Inst.
A REVIEW OF SILICON CARBIDE, by C. G. Harman and W. G. Mixer, Jr. June 3, 1952. 46p. (BMI-748)

BNL-171 4801
Brookhaven National Lab.
CONFERENCE ON FISSION PRODUCT UTILIZATION [HELD ON] FEBRUARY 18-19, 1952. [nd] 49p. (BNL-171)

BNL-177 4802
Brookhaven National Lab.
QUARTERLY PROGRESS REPORT JANUARY 1 - MARCH 31, 1952; UNCLASSIFIED SECTION. [nd] 47p. (BNL-177)

CF-52-6-99 4965
[Oak Ridge National Lab.]
ENERGY ABSORPTION OF CAPTURE GAMMAS, by H. L. F. Enlund. June 11, 1952. 6p. (CF-52-6-99)

ISC-224 4803
Ames Lab.
PROGRESS REPORT IN PHYSICS FOR THE PERIOD JULY 1, 1951 TO DECEMBER 31, 1951, by G. W. Fox, J. F. Carlson, G. C. Danielson, D. E. Hudson, E. N. Jensen, J. K. Knipp, J. M. Keller, L. J. Laslett, S. Legvold, G. Miller and D. Zaffarano. May 1, 1952. 37p. (ISC-224)

ISC-224(sects.II, III, and IV) 4983
Ames Lab.
RADIATION STUDIES, STUDIES OF NUCLEI, AND THEORETICAL PHYSICS, sects.II, III, and IV of PROGRESS REPORT IN PHYSICS FOR THE PERIOD JULY 1, 1951 TO DECEMBER 31, 1951, by G. W. Fox, J. F. Carlson, G. C. Danielson, D. E. Hudson, E. N. Jensen, J. K. Knipp, J. M. Keller, L. J. Laslett, S. Legvold, G. Miller and D. Zaffarano. May 1, 1952. 16p. (ISC-224(sects.II, III, and IV))

ISC-224(sect.V) 4804
Ames Lab.
SOLID STATE PHYSICS, sect.V of PROGRESS REPORT IN PHYSICS FOR THE PERIOD JULY 1, 1951 TO DECEMBER 31, 1951, by G. W. Fox, J. F. Carlson, G. C. Danielson, D. E. Hudson, E. N. Jensen, J. K. Knipp, J. M. Keller, L. J. Laslett, S. Legvold, G. Miller and D. Zaffarano. May 1, 1952. 13p. (ISC-224(sect.V))

KLX-1374 4764
Vitro Corp. of America
INTERIM SUMMARY DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT (24-A4); JOB 24; PERIOD SEPTEMBER 1, 1950–MARCH 1, 1952. June 6, 1952. 51p. (KLX-1374)

KLX-1376 4765
Vitro Corp. of America
BI-MONTHLY PROGRESS REPORT MARCH - APRIL, 1952; DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT. June 26, 1952. 4p. (KLX-1376)

MLM-713 4852
Mound Lab.
INSTRUMENTATION AND TECHNIQUES, QUARTERLY PROGRESS THROUGH JUNE 17, 1952, by J. W. Heyd. June 30, 1952. 6p. (MLM-713)

NAA-SR-89 4781
North American Aviation, Inc.
KINETICS OF ORDERING IN THE ALLOY AuCu, by G. J. Dienes. Issued Aug. 30, 1950. 36p. (NAA-SR-89)

NAA-SR-100 4867
North American Aviation, Inc.
STATISTICS OF FOIL COUNTING, by E. R. Cohen. Issued Sept. 11, 1950. 8p. (NAA-SR-100)

NAA-SR-175 4782
North American Aviation, Inc.
ORDER - DISORDER THEORY, by D. B. Bowen. Issued June 4, 1952. 32p. (NAA-SR-175)

NAA-SR-185 4681
North American Aviation Inc.
LOW TEMPERATURE STEAM POWER CYCLES FOR WATER COOLED REACTORS, by C. H. Robbins. Issued May 28, 1952. 23p. (NAA-SR-185)

NAA-SR-187 4984
North American Aviation, Inc.
CONTRIBUTION BY CHEMICAL ELEMENT TO THE TOTAL BETA ACTIVITY OF FISSION PRODUCTS, by F. J. Keneshea, Jr. and A. M. Saul. Issued June 13, 1952. 29p. (NAA-SR-187)

NYO-582 4794
Massachusetts Inst. of Tech.
SOLID SOLUTIONS AND GRAIN BOUNDARIES; TECHNICAL PROGRESS REPORT NO. 10, SCOPE II, by B. L. Averbach, M. Cohen, P. A. Flinn, E. E. Underwood, W. F. Flanagan, P. S. Rudman and J. Hilliard. Mar. 31, 1952. 5p. (NYO-582; Technical Progress Report No. 10)

NYO-861 4795
Massachusetts Inst. of Tech.
FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION; TECHNICAL PROGRESS REPORT NO. 6, SCOPE III, by B. L. Averbach, M. Cohen, S. Allen, G. P. Conard, and P. Fopiano. Mar. 31, 1952. 4p. (NYO-861; Technical Progress Report No. 6)

NYO-949 4796
Pittsburgh Univ.
THERMODYNAMICS OF CRYSTALLINE SOLUTIONS; PROGRESS REPORT FOR APRIL 1, 1952 TO JULY 1, 1952, by W. E. Wallace, R. S. Craig, L. W. Coffer, D. A. Edwards and R. A. Flinn. July 7, 1952. 10p. (NYO-949)

NYO-1646 4694
Atomic Energy Project, Western Reserve Univ.
MONTHLY PROGRESS REPORT APRIL, 1952, by Hymer L. Friedell. [nd] 6p. (NYO-1646)

NYO-3118 4752
Horizons, Inc.
TECHNICAL PROGRESS REPORT [FOR] THIRD AND FOURTH QUARTERS [COVERING PERIOD] DECEMBER 1, 1951 TO MAY 31, 1952 [ON] THE PRODUCTION OF ZIRCONIUM BY FUSED SALT ELECTROLYSIS, by Merle E. Sibert and Morris A. Steinberg. June 18, 1952. 28p. (NYO-3118)

NYO-3198 4945
Columbia Univ.
REACTIONS OF 370 MEV PROTONS WITH COBALT, by E. Belmont. Apr. 21, 1952. 74p. (NYO-3198)

NYO-3215 4895
Rochester Univ.
THE TOTAL CROSS SECTIONS OF POSITIVE PIONS IN HYDROGEN, by S. W. Barnes, D. L. Clark, J. P. Perry and C. E. Angell. June 24, 1952. 7p. (NYO-3215)

NYO-3216 4896
Rochester Univ.
ON THE ξ° MESON, by M. F. Kaplon and D. M. Ritson. June 24, 1952. 4p. (NYO-3216)

NYO-3302 4918
Carnegie Inst. of Tech.
THE THREE-PHOTON ANNIHILATION OF POSITRONS AND ELECTRONS (thesis), by Robert T. Siegel. May 26, 1952. 52p. (NYO-3302)

NYO-3374 4744
Pennsylvania State Coll.
CONCERNING THE BEHAVIOR OF AQUEOUS THENOYL-TRIFLUOROACETONE, by Edward H. Cook and Robert W. Taft, Jr. June 7, 1952. 10p. (NYO-3374)

NYO-3554 4753
Syracuse Univ.
FRACTIONATION OF SOME RARE EARTH PAIRS BY PRECIPITATION FROM HOMOGENEOUS SOLUTION, by Louis Gordon and Kenneth J. Shaver. May 22, 1952. 18p. (NYO-3554)

ORNL-1288 4759
Oak Ridge National Lab.
THE SYNTHESES OF 2-TRIFLUOROACETO(ACETYL-1-C^{14})-THIOPHENE AND 2-(HEPTADECYL-1-C^{14})-IMIDAZOLINE; PART I, by Vernon F. Raaen and Gus A. Ropp and PART II, by Vernon F. Raaen, O. Kenton Neville, and Gus A. Ropp. Issued July 14, 1952. 9p. (ORNL-1288)

ORO-72 4719
Virginia Univ. Medical School
GLYCOLYSIS AND PHOSPHATE TURNOVER IN THE HUMAN ERYTHROCYTE, by D. R. H. Gourley. [nd] 17p. (ORO-72)

ORO-73 4720
Virginia Univ., Medical School
THE ROLE OF ADENOSINE TRIPHOSPHATE IN THE TRANSPORT OF PHOSPHATE IN THE HUMAN ERYTHROCYTE, by D. R. H. Gourley. [nd] 28p. (ORO-73)

SO-2021 4727
General Electric Research Lab.
THE SELF-DIFFUSION OF LIQUID MERCURY, by R. E. Hoffman. June 1952. 13p. (SO-2021; RL-693)

UCLA-203 4682
Atomic Energy Project, Univ. of Calif., Los Angeles
STUDIES ON THE AEROBIC CARBOHYDRATE METABOLISM OF LEUKOCYTES IN HEALTH AND LEUKEMIA, by William S. Beck and William N. Valentine. Issued June 13, 1952. 28p. (UCLA-203)

UCRL-1750 4960
Radiation Lab., Univ. of Calif.
UNIVERSITY OF CALIFORNIA RADIATION LABORATORY 6.4 BEV BEVATRON RF SYSTEM, by C. N. Winningstad, D. Paxson, O. Anderson, Q. Kerns, and J. Riedel. Apr. 15, 1952. 43p. (UCRL-1750)

UCRL-1775 4946
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING, by Bonnie E. Cushman. May 26, 1952. 6p. (UCRL-1775)

UCRL-1792 4947
Radiation Lab., Univ. of Calif.
DEUTERON PHOTODISINTEGRATION AT HIGH ENERGIES, by W. S. Gilbert and J. W. Rosengren. May 9, 1952. 22p. (UCRL-1792)

UCRL-1819 4897
Radiation Lab., Univ. of Calif.
ON THE REACTIONS $p + d \rightarrow \pi^{+} + H^{3}$ AND $p + d \rightarrow \pi^{0} + He^{3}$, by M. Ruderman. May 14, 1952. 9p. (UCRL-1819)

UCRL-1827 4961
Radiation Lab., Univ. of Calif.
A SIMPLIFIED CYCLOTRON BEAM SNOUT, by T. M. Putnam. June 4, 1952. 11p. (UCRL-1827)

UCRL-1831 4728
Radiation Lab., Univ. of Calif.
GASEOUS HYDRATED OXIDES, HYDROXIDES, AND OTHER HYDRATED MOLECULES (thesis), by Guy R. B. Elliott. June 1952. 56p. (UCRL-1831)

UCRL-1832 4919
Radiation Lab., Univ. of Calif.
SUMMARY OF WEEKLY RESEARCH PROGRESS MEETINGS OF FEBRUARY 7 AND FEBRUARY 14, 1952, by S. Shewchuck. May 26, 1952. 5p. (UCRL-1832)

UCRL-1840 4926
Radiation Lab., Univ. of Calif.
SUMMARY OF WEEKLY RESEARCH PROGRESS MEETING OF MAY 22, 1952, by Sergey Shewchuck. June 2, 1952. 6p. (UCRL-1840)

UCRL-1842 4966
Radiation Lab., Univ. of Calif.
A STUDY OF THE PICK-UP PROCESS IN PROTON-DEUTERON SCATTERING (thesis), by Alexander Bratenahl. June 2, 1952. 75p. (UCRL-1842)

UCRL-1846 4760
Radiation Lab., Univ. of Calif.
THE SYNTHESIS OF VALINE-2-C^{14}, by P. T. Adams and B. M. Tolbert. June 11, 1952. 4p. (UCRL-1846)

UR-197 4715
Atomic Energy Project, Univ. of Rochester
THE RELATION OF PARTICLE SIZE OF URANIUM DIOXIDE DUST TO TOXICITY FOLLOWING INHALATION BY ANIMALS—II., by Herbert B. Wilson, George E. Sylvester, Sidney Laskin, Charles W. LaBelle, James K. Scott and H. E. Stokinger. June 6, 1952. 25p. (UR-197)

UR-203 4721
Atomic Energy Project, Univ. of Rochester
L-HISTIDINE-2-C^{14}, ITS SYNTHESIS AND SOME ASPECTS OF ITS METABOLISM IN RATS, by Milton Toporek. June 11, 1952. 90p. (UR-203)

UR-205 4695
Atomic Energy Project, Univ. of Rochester
QUARTERLY TECHNICAL REPORT, JANUARY 1, 1952 THRU MARCH 31, 1952, by Henry A. Blair. May 14, 1952. 72p. (UR-205)

UR-205(p.3-7) 4696
Atomic Energy Project, Univ. of Rochester
INTERIM REPORT ON TWO-YEAR EXPERIMENTAL INHALATION STUDIES OF $BeSO_4$ AT A LEVEL OF 4 μg Be/m^3, AND EXCRETION OF RADIUM BY DOGS AFTER A SINGLE INTRAVENOUS INJECTION, p.3-7 of QUARTERLY TECHNICAL REPORT, JANUARY 1, THRU MARCH 31, 1952, by Henry A. Blair. May 14, 1952. 5p. (UR-205(p.3-7))

UR-205(p.11-30) 4697
Atomic Energy Project, Univ. of Rochester
STUDIES ON THE QUANTITATIVE SEPARATION OF PROTEIN BOUND IODINE FROM IODIDE, AND THE PREVENTION OF X-IRRADIATION INDUCED HYPERGLYCEMIA IN RABBITS BY MEANS OF INSULIN, p.11-30 of QUARTERLY TECHNICAL REPORT, JANUARY 1, 1952 THRU MARCH 31, 1952, by Henry A. Blair. Mar 14, 1952. 20p. (UR-205 (p.11-30))

UR-205(p.31-47) 4698
Atomic Energy Project, Univ. of Rochester
PROTECTION OF THE X-IRRADIATED DOG WITH EXTER-

NAL ABDOMINAL SHIELDING, AND PRELIMINARY REPORT ON SOME CLINICAL FEATURES OF THE RADIATION SYNDROME COMPLICATED BY INDUCED INFECTION, p.31-47 of QUARTERLY TECHNICAL REPORT, JANUARY 1, 1952 THRU MARCH 31, 1952, by Henry A. Blair. May 14, 1952. 17p. (UR-205(p.31-47))

UR-205(p.48-59) 4699
Atomic Energy Project, Univ. of Rochester
STUDIES RELATIVE TO THE PHAGOCYTIC ACTIVITY OF LEUKOCYTES IN IRRADIATED DOGS, AND THE EFFECT OF RUTIN ON THE X-IRRADIATED DOG, p.48-59 of QUARTERLY TECHNICAL REPORT, JANUARY 1, 1952 THRU MARCH 31, 1952, by Henry A. Blair. May 14, 1952. 12p. (UR-205(p.48-59))

UR-205(p.60-71) 4700
Atomic Energy Project, Univ. of Rochester
A METHOD FOR COMPLETE EXTRACTION OF EMBEDDING MATERIAL FROM TISSUE SECTIONS FOR THE ELECTRON MICROSCOPE, AND A NEW MICROTOME FOR THIN-SECTIONING FOR ELECTRON MICROSCOPY, p.60-71 of QUARTERLY TECHNICAL REPORT, JANUARY 1, 1952 THRU MARCH 31, 1952, by Henry A. Blair. May 14, 1952. 12p. (UR-205(p.60-71))

UR-208 4722
Atomic Energy Project, Univ. of Rochester
TETRAPYRROL PRECURSORS OF PROTOPORPHYRIN IX; I. UROPORPHYRIN III, by K. Salomon, J. E. Richmond, and K. I. Altman. May 19, 1952. 12p. (UR-208)

UR-209 4713
Atomic Energy Project, Univ. of Rochester
RELATIVE EFFECTS OF ALPHA, BETA, GAMMA, AND NEUTRON RADIATION; THE SIGNIFICANCE OF THESE DIFFERENCES IN RADIATION THERAPY, by William F. Bale. May 28, 1952. 21p. (UR-209)

UR-210 4701
Atomic Energy Project, Univ. of Rochester
SERUM AND URINARY FIBRINOLYTIC ACTIVITY RELATED TO THE HEMORRHAGIC DIATHESIS IN IRRADIATED DOGS, by J. Colgan, E. Gates and L. L. Miller. June 2, 1952. 26p. (UR-210)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE-C/R-876 4762
Atomic Energy Research Establishment, Harwell, Berks (England)
THE MAGNETIC SUSCEPTIBILITY OF SODIUM PLUTONYL ACETATE, by J. K. Dawson. Feb. 22, 1952. 5p. (AERE-C/R-876)

AERE-G/M-130 4943
Atomic Energy Research Establishment, Harwell, Berks (England)
IDENTIFICATION OF (γ,pα) REACTIONS IN NUCLEAR EMULSIONS, by M. J. Brinkworth, F. K. Goward, and J. J. Wilkins. Apr. 4, 1952. 7p. (AERE-G/M-130)

AERE-T/R-864 4959
Atomic Energy Research Establishment, Harwell, Berks (England)
A NEW CALCULATION OF SLOT DEPTH FOR THE METAL LOADED LINEAR ACCELERATOR, by W. Walkinshaw and J. S. Bell. Feb. 1952. 13p. (AERE-T/R-864)

AERE-T/R-875 4925
Atomic Energy Research Establishment, Harwell, Berks (England)
STUDIES IN jj-COUPLING. II. FRACTIONAL PARENTAGE COEFFICIENTS AND THE CENTRAL FORCE ENERGY MATRIX FOR EQUIVALENT PARTICLES, by B. H. Flowers and A. R. Edmonds. Feb. 1952. 28p. (AERE-T/R-875)

NACA-TN-2561 4771
New York Univ.
A STUDY OF POISSON'S RATIO IN THE YIELD REGION, by George Gerard and Sorrel Wildhorn. Jan. 1952. 30p. (NACA-TN-2561)

NACA-TN-2736 4768
Lewis Flight Propulsion Lab., NACA
TWO-DIMENSIONAL SHEAR FLOW IN A 90° ELBOW, by James J. Kramer and John D. Stanitz. June 1952. 44p. (NACA-TN-2736)

NACA-TN-2733 4767
Lewis Flight Propulsion Lab., NACA
METHOD FOR CALCULATION OF HEAT TRANSFER IN LAMINAR REGION OF AIR FLOW AROUND CYLINDERS OF ARBITRARY CROSS SECTION (INCLUDING LARGE TEMPERATURE DIFFERENCES AND TRANSPIRATION COOLING), by E. R. G. Eckert and John N. B. Livingood. June 1952. 71p. (NACA-TN-2733)

NBS-1752 4758
National Bureau of Standards
LACTOSE-1-C^{14} AND LACTOBIONIC-1-C^{14} DELTA LACTONE. A STUDY OF THE CYANOHYDRIN SYNTHESIS ON 3-β-D-GALACTOSYL-ARABINOSE, by Harriet L. Frush and Horace S. Isbell. June 30, 1952. 17p. (NBS-1752)

NP-3860 4868
Welch, W. M., Manufacturing Co.
FINAL REPORT; RADIATION DOSIMETER READER, by Stanton H. Petry and Lawrence Kelsey. [nd] 37p. (NP-3860; U22261)

NP-3865 4783
Institute of Engineering Research, Univ. of Calif.
SOME OBSERVATIONS ON CORRELATIONS BETWEEN THE CREEP BEHAVIOR AND THE RESULTING STRUCTURES IN ALPHA SOLID SOLUTIONS; NINETEENTH TECHNICAL REPORT, by Oleg D. Sherby and John E. Dorn. Apr. 15, 1952. 33p. (NP-3865; U22253)

NP-3876 4754
Cryogenic Lab., Ohio State Univ.
A NOTE ON THE VIBRATIONAL FREQUENCIES AND THE ENTROPY OF DECABORANE, by W. E. Keller and H. L. Johnston. Apr. 16, 1952. 14p. (NP-3876; TR-328-16; U22324)

NP-3879 4784
Physical Metallurgy Lab., Calif. Inst. of Tech.
THE MARTENSITE TRANSFORMATION TEMPERATURE IN TITANIUM BINARY ALLOYS; THIRD TECHNICAL REPORT, by Pol Duwez. Apr. 1952. 14p. (NP-3879; U22249)

NP-3887 4869
Department of Mines and Technical Surveys (Canada)
THE ROSENBLUM SPARK COUNTER, by G. G. Eichholz. Mar. 18, 1952. 15p. (NP-3887; TR-97/52)

NP-3893 4777
Metals Corrosion Lab., Bureau of Mines
CORROSION STUDIES ON TITANIUM AND ZIRCONIUM METALS; MONTHLY REPORT FOR MAY 1952, by L. B. Golden, W. L. Acherman and W. Mace. [nd] 8p. (NP-3893)

NP-3903 4785
Armour Research Foundation
EXPLORATION OF VANADIUM BASE ALLOYS; REPORT NO. 4 (FOURTH QUARTERLY REPORT); NOVEMBER 9, 1951 – FEBRUARY 8, 1952. Feb. 29, 1952. 27p. (NP-3903; ATI-135688; Report No. 4)

NP-3904 4786
Armour Research Foundation
EXPLORATION OF VANADIUM-BASE ALLOYS; REPORT NO. 1 (FIRST QUARTERLY REPORT), by William Wilson, Jr. and M. Hansen. June 20, 1951. 13p. (NP-3904; ATI-105970; Report No. 1)

NP-3906 4787
Tour, Sam and Co., Inc.
RESEARCH AND DEVELOPMENT OF METHODS OF VAPOR DEPOSITED COATINGS FOR TITANIUM AND TITANIUM ALLOYS; FINAL TECHNICAL REPORT, by Mohammed S. Hyder. Apr. 21, 1952. 33p. (NP-3906; WAL Report No. 401/48/B-10)

NP-3926 4788
Armour Research Foundation
RESEARCH AND DEVELOPMENT TOWARD IMPROVING TITANIUM-ALUMINUM BINARY ALLOYS BY THE ADDITION OF A THIRD COMPONENT; INTERIM TECHNICAL REPORT NO. 1, SEPTEMBER 1–DECEMBER 31, 1951. [nd] 29p. (NP-3926; Interim Technical Report No. 1; U22482)

NP-3931 4789
Battelle Memorial Inst.
FIRST INTERIM REPORT ON A SURVEY OF THE LITERATURE ON HYDROGEN IN TITANIUM TO WATERTOWN ARSENAL, by G. A. Lenning, C. M. Craighead, and R. I. Jaffee. Apr. 1, 1952. 40p. (NP-3931)

NP-3934 4870
New York Univ.
FOURTH QUARTERLY REPORT FOR MONTHS INCLUDING NOVEMBER, DECEMBER, JANUARY; RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. May 1952. 88p. (NP-3934; U22563)

NP-3941 4912
Massachusetts Inst. of Tech.
A STUDY OF ATMOSPHERIC VORTICITY, by Richard J. Reed. Oct. 15, 1951. 32p. (NP-3941; Technical Report No. 10; U19871)

NP-3943 4790
Battelle Memorial Inst.
SECOND INTERIM REPORT ON THE NATURE OF THE LINE MARKINGS IN TITANIUM AND ALPHA TITANIUM ALLOYS TO WATERTOWN ARSENAL, by C. M. Craighead, G. A. Lenning, and R. I. Jaffee. Apr. 15, 1952. 10p. (NP-3943)

NP-3944 4791
Battelle Memorial Inst.
FIRST INTERIM REPORT ON THE EFFECT OF MICROSTRUCTURE ON THE MECHANICAL PROPERTIES OF TITANIUM ALLOYS TO WATERTOWN ARSENAL, by F. C. Holden, D. J. Maykuth, H. R. Ogden and R. I. Jaffee. Mar. 12, 1952. 45p. (NP-3944)

NP-3945 4748
Tracerlab, Inc.
CHEMICAL SYSTEMS SENSITIVE TO RADIATION; MONTHLY REPORT NO. 4 [FOR] OCTOBER 1, 1951–OCTOBER 31, 1951. Oct. 31, 1951. 18p. (NP-3945; Monthly Report No. 4; U20006)

NP-3946 4944
Randal Morgan Lab. of Physics, Univ. of Penna.
IONIZATION MEASUREMENT OF $B^{10}(n,\alpha)Li^7$, by J. Rhodes, W. Franzen and W. E. Stephens. Mar. 31, 1952. 18p. (NP-3946; Technical Report No. 6)

NP-3947 4792
Armour Research Foundation
DEVELOPMENT OF PHASE EQUILIBRIUM DIAGRAMS FOR THE TITANIUM-RICH PORTIONS OF THE TERNARY SYSTEMS Ti-Mn-Al, Ti-Cr-Mo, AND Ti-Mn-Mo; INTERIM TECHNICAL REPORT NO. 2 [FOR] FEBRUARY 1, 1952–MAY 31, 1952. [nd] 24p. (NP-3947; Interim Technical Report No. 2)

NP-3948 4793
Carnegie Inst. of Tech.
GALLING AND SEIZING CHARACTERISTICS OF TITANIUM AND TITANIUM-BASE ALLOYS; INTERIM TECHNICAL REPORT NO. 1 [FOR] OCTOBER 15, 1951–APRIL 15, 1952. [nd] 15p. (NP-3948; Interim Technical Report No. 1)

NP-3949 4746
Minnesota Univ.
THE POTENTIAL FUNCTION OF ETHYLENE, by Bryce L. Crawford, Jr., John E. Lancaster and Richard G. Inskeep. June 1, 1952. 19p. (NP-3949)

NP-3954 4913
Mallinckrodt Chemical Lab., Harvard Univ.
APPROXIMATE TREATMENT OF THE EFFECT OF CENTRIFUGAL DISTORTION ON THE ROTATIONAL ENERGY LEVELS OF ASYMMETRIC ROTOR MOLECULES, by Daniel Kivelson and E. Bright Wilson, Jr. [nd] 15p. (NP-3954; U22488)

NP-3962 4853
Allis-Chalmers Manufacturing Co.
DEVELOPMENT OF ELECTROMAGNETIC PUMPS SUITABLE FOR PUMPING LIQUID METALS; PROGRESS REPORT ON 100 KW UNIPOLAR GENERATOR, by Edward L. Young. July 1, 1952. 16p. (NP-3962; Interim Progress Report No. 10)

NP-3965 4871
Electrona Corp.
DEVELOPMENT OF RADIACMETER IM-79( )/PD; FIRST QUARTERLY PROGRESS REPORT COVERING PERIOD FEBRUARY 15 TO MAY 15, 1952, by Carl Bosch. [nd] 42p. (NP-3965)

NP-3966 4843
Research Lab. of Electronics, Mass. Inst. of Tech.
PROBE STUDIES OF ENERGY DISTRIBUTIONS AND RADIAL POTENTIAL VARIATIONS IN A LOW-PRESSURE MERCURY ARC, by R. M. Howe. Jan. 18, 1952. 28p. (NP-3966; Technical Report No. 221)

NP-3968 4959
Little, Arthur D., Inc.
INDUSTRIAL USES OF RADIOACTIVE MATERIALS; A SELECTED BIBLIOGRAPHY. Mar. 1949. 18p. (NP-3968)

TEI-236 4733
Geological Survey
A THEORETICAL TREATMENT OF THE ABSORPTION CHARACTERISTICS OF THE DITHIZONE MIXED-COLOR SYSTEM, by Robert G. Milkey. May 1952. 12p. (TEI-236)

NUCLEAR SCIENCE ABSTRACTS

Vol. 6 August 31, 1952 No. 16

GENERAL

ATOMIC POWER

4681

North American Aviation Inc.

LOW TEMPERATURE STEAM POWER CYCLES FOR WATER COOLED REACTORS, by C. H. Robbins. Issued May 28, 1952. 23p. (NAA-SR-185)

In certain types of reactors, the temperature of the coolant may seriously limit the temperature at which steam for a power cycle can be generated. This report discusses steam cycles when the temperature is limited to some value less than about 500°F. Saturated rather than superheated steam should be generated if the top steam temperature is less than about 500°F and the condenser pressure is greater than about ½ inch of Hg. Superheating at the expense of pressure under these conditions adversely affects cycle efficiency. Moisture problems may be serious for these low-temperature steam cycles, but the amount of moisture in the turbine steam may be reduced by various methods which do not reduce cycle efficiency. Reheating is a familiar means of reducing moisture. An unusual method suggested is to place a steam separator in the crossover between high- and low-pressure turbines. Regenerative feed water heating is a valuable means of increasing cycle efficiency. In some cases, reactor coolant conditions may create a conflict between maximizing steam pressure and using feed water heating. Steam power plants using saturated steam less than 500°F will have lower thermal efficiencies, higher investment costs and higher operating costs than conventional plants. (auth)

BIOLOGY AND MEDICINE

4682

Atomic Energy Project, Univ. of Calif., Los Angeles

STUDIES ON THE AEROBIC CARBOHYDRATE METABOLISM OF LEUKOCYTES IN HEALTH AND LEUKEMIA, by William S. Beck and William N. Valentine. Issued June 13, 1952. 28p. (UCLA-203)

Data are presented on the O consumption, glucose utilization, and lactic acid production of homogenates of leukocytes isolated from normal (N), chronic myelocytic (CML) and chronic lymphatic (CLL) leukemic blood. Glucose utilization was determined by the highly specific glucose oxidase method which gives higher disappearance rates than the reducing method. Tissues were incubated in buffered media containing added diphosphopyridine nucleotide (DPN), adenosine triphosphate (ATP), cytochrome c, phosphate, Mg^{++}, and various substrates. Data were expressed per 10^{10} cells. With glucose and hexose diphosphate as substrates, O consumption, glucose utilization and lactic acid production were significantly higher in N homogenates than in CML and CLL. Lactic acid production and glucose utilization were higher in CML than in CLL. Leukocytes have a predominantly aerobic glycolytic metabolism. The ratio of aerobic glycolysis to respiration (in terms of glucose equivalents) is about 30 in N and CML and about 15 in CLL.

4683

THE ANALYSIS AND SEPARATION OF GLUCURONIC AND GALACTURONIC ACIDS BY ION EXCHANGE. J. X. Khym and D. G. Doherty. J. Am. Chem. Soc. 74, 3199-3200(1952) June.

A method is reported for both the qualitative and quantitative determination of the uronic acids with a complete recovery of the pure individual acids as crystalline materials.

RADIATION EFFECTS

4684

Notre Dame Univ.

TEMPERATURE EFFECT ON IRRADIATION DAMAGE IN BACTERIOPHAGE, by C. S. Bachofer. [nd] 2p. (AECU-2100)

In order to establish the effect of temperature on the direct action of ionizing radiations in biological systems, bacteriophage T1, specific for Escherichia coli, strain B, was irradiated with x rays at temperatures from 77° to 310°K. Material was irradiated in vacuo in a specially constructed chamber to prevent freezing, liquefaction of air, and interference of oxygen. Three series of experiments utilized (1) phage in broth, lyophilized; (2) phage in broth, vacuum-dried; and (3) phage in chemically defined medium, vacuum-dried. No inactivation due to temperature alone was observed at temperatufes as low as 77°K or as high as 310°K, for the duration of the experiments. Experimental results show that survival of bacteriophage after irradiation with a given dose of x rays is inversely proportional to the temperature at which they are irradiated, that is, there exists an inverse correlation between radiation damage and temperature. The relationship between temperature-of-irradiation and survival varies with the physical state of the irradiated virus. This has been defined mathematically for the three sets of experiments listed above, as follows: (1) The relationship between titer and temperature is $y = a - 1.54x$ where y is the titer, expressed in millions of phage particles per ml, at a given temperature-of-irradiation x, when a is the titer at 0°K; (2) $y = a - 3.28x$; and (3) $y = a - 1.65x$. (Entire report)

4685

Notre Dame Univ.

DIRECT EFFECT OF X-RAYS ON BACTERIAL VIRUSES MODIFIED BY PHYSICAL STATE AND RELATED TO THE TARGET THEORY, by C. S. Bachofer. [nd] 11p. (AECU-2101)

An investigation is reported on the effect of the physical condition of dry bacteriophage particles on their resistance to x irradiation. Great differences were found in the effectiveness of x rays on viruses which had been dried by different methods, but in all other respects handled exactly the same. An hypothesis is presented for the difference of effectiveness of x rays on dried and lyophilized phage. The target theory of inactivation is discussed.

4686

Notre Dame Univ.

PROTECTION OF BACTERIOPHAGE AGAINST X-RAYS BY HIGH CONCENTRATIONS OF A NEUTRAL SALT, by C. S. Bachofer and M. Aelred Pottinger. [nd] 25p. (AECU-2102)

Protection of bacteriophage T1 against x rays was tested in the presence of concentrations of $(NH_4)_2SO_4$ ranging from 10^{-6}M to saturation (4.26M). Survival of T1 in concentrations of 10^{-6} to 10^{-3}M after irradiation did not differ significantly from survival in distilled water after irradiation. From 10^{-3}M to 10^{-1}M there was a steep rise in survival, with a leveling off as the concentration approached saturation, giving over-all a two thousandfold increase in survival. The mechanism of "salting out" protection in these experiments is apparently due chiefly to dehydration, which protects the virus particles against the indirect effects of x irradiation. Post-irradiation effects, tested by the inactivation of phage added to irradiated media, approach in magnitude the effects obtained by irradiation of the phage themselves in the various solutions. Filter paper adsorption analyses indicate a close correlation between concentrations of $(NH_4)_2SO_4$, ability of the filter paper to adsorb phage, and protection against x rays, both during and after irradiation. (auth)

4687

Argonne National Lab.

BIOLOGIC AND PHYSICAL ASPECTS OF THE ACTION OF TWO RADIATIONS OF DIFFERENT SPECIFIC IONIZATION, By Joanne W. Hollcroft and Egon Lorenz. National Cancer Inst. and Argonne National Lab. May 1952. 26p. (AECU-2109; UAC-580)

A comparison was made of the biological effects on mice of x and α radiation. As an internal α emitter, radon was measured after intravenous and intraperitoneal injection. The total dose was calculated on the basis that, at the time of injection, radon was in equilibrium with its short-lived decay products, and doses were injected of from 0.013 to 0.017 μc/g of mouse, corresponding to energy doses of 33,800 to 44,200 ergs/g. For comparison, mice of the same strain, sex, and age were exposed to doses of 480 to 645-r total-body x radiation, or energy units equivalent to 44,600 to 60,000 ergs/g of tissue. No significant differences in the degree of response of the leukocyte count to radon in equilibrium with its decay products or to x irradiation of comparable dose was found in mice, the effects of whole-body irradiation with radon or x radiation on the regression of a transplantable mouse lymphosarcoma also showed for comparable doses similar tumor regression, and for corresponding energy dose the total-body suspense, as measured by the loss and recovery of the weight of testes, was found to be the same. It was concluded that apparently the difference in specific ionization does not enter the picture, nor does the uneven distribution of the emitters in the body alter response to any great extent.

4688

Argonne National Lab.

DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 132p. (ANL-4745)

Separate abstracts have been prepared on the following sections of this report: Chronic External Irradiation and Neutron Radiobiology, p.14-42; Physiology, Radium Toxicology, and Experimental Pathology, p.43-52; Experimental Surgery, Clinical Investigation, and Radiochemistry, p.53-70; Special Problems, Plant Physiology, Microbiology, and Biochemistry, p.73-93; and Physiological Chemistry, Physical Chemistry, Pharmacology, Theoretical Biology, and Biophysics, p.94-126.

4689

Argonne National Lab.

CHRONIC EXTERNAL IRRADIATION AND NEUTRON RADIOBIOLOGY, p.14-42 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 29p. (ANL-4745(p.14-42))

Preliminary data on survival of irradiated mice treated with injections of bone marrow are presented. Data on the survival patterns in tissue culture following acute doses of x radiation are presented for doses from 250 to 2000 r. Results of a study of the effects of spleen protection on lymphoid tumors induced in mice by total-body irradiation suggest that prolonged depression of hematopoietic activity may be a factor in eliciting lymphoid tumors. The construction of an instrument that will continuously record and analyze the CO_2 and O concentrations in respired air is reported. A schematic diagram of the instrument is included. Loading of Co^{60} sources is described in a radiation exposure chamber constructed to provide a source of fast neutrons at one end and a source of γ rays at the other. The survival of mice in which the circulation to the shielded spleen was clamped off during exposure of the animal to 950 r and in which the clamp is released immediately after irradiation was found to be approximately the same as survival in animals with spleen shielded without clamping. In a small group of mice studied, pretreatment with cysteine followed by spleen implantation after irradiation were additive in enhancing survival. Survival following spleen protection during irradiation was found to be higher in mice between the ages of 6 to 12 weeks than in mice between 4 to 6 weeks of age. Results of tests using 138 mice are presented in tabular form. Possible explanations for the decreased survival observed in younger mice are disucssed.

4690

Argonne National Lab.

PHYSIOLOGY, RADIUM TOXICOLOGY, AND EXPERIMENTAL PATHOLOGY, p.43-52 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 10p. (ANL-4745(43-52))

Possible explanations of the radiation protection in mammals afforded by cysteine are discussed. Preliminary data from a study of the rate of disappearance of $RaSO_4$ dust from the human lung approximately six months after accidental inhalation indicate the rate of elimination from the lung may vary significantly from patient to patient and that the patient showing the lowest lung elimination rate exhibits the lowest Rn-to-total Ra ratio. It is also indicated that the rate of elimination from the lung is definitely faster than the rate of elimination from the whole body within the observation period reported. Comparison of mice fed a diet containing aureomycin with those on a comparable diet without an antibiotic led to the conclusion that 1.4 mg aureomycin/lb has no growth stimulating effect on female mice between 5 and 11 weeks of age, the sudden exclusion of aureomycin from the diet of animals that had received it from weaning to 5 to 6 weeks of age seems to have no detrimental effect, and this dose of aureomycin is not great enough to eliminate intestinal infections. Preliminary data from a study of the toxicity of C^{14} indicate that a total dose of 500 μc of C^{14} given to rats and mice (2.5 μc/g and 20 μc/g, respectively) has little effect upon longevity and moribundity. There is the suggestion that among C^{14}-treated mice the incidence of lymphomas was slightly elevated and the incidence of lung tumors was decreased.

4691

Argonne National Lab.

EXPERIMENTAL SURGERY, CLINICAL INVESTIGATION, AND RADIOCHEMISTRY, p.53-70 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 18p. (ANL-4745(53-70))

Data on the incorporation of injected C^{14}-labeled glycine into fibrin, globulin and albumin fractions of plasma in rats are presented graphically. The average ratios of pre- and postirradiation amino acid N values in dogs was determined. Tentative conclusions reached from a study of the metabolism of dextran indicate that it is metabolized similarly by the rat, dog, and man; the rate of dextran excretion and metabolism depends on the metabolic needs of the animal; about 50% of the injected dextran is excreted as such during the first three days, while a large part of that remaining in the animal is oxidized to CO_2 over a longer period of time; and after intravenous administration no dextran, nor any of its metabolic products, is excreted by way of the intestine. An apparatus for quantitatively collecting exhaled CO_2 and separating urine and feces from the rat is described. The lower part of the body is immobilized but the upper body is allowed free movement. Sodium salicylate, when given in adequate doses, was found to be quite effective against experimental Be poisoning in mice. Analogs of salicylic acid without the ortho-hydroxycarboxylic acid groupings were found to be uniformly ineffective. Sodium salicylate afforded protection when treatment with 400 mg/kg was delayed 8 hr but not when treatment was delayed 24 hr. The role of the chelating action of the ortho-hydroxycarboxylic acid structure on the ionized Be is discussed. The complex P compounds of neutron-irradiated rat bones were studied by electromigration.

4692

Argonne National Lab.

SPECIAL PROBLEMS, PLANT PHYSIOLOGY, MICROBIOLOGY, AND BIOCHEMISTRY, p.73-93 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 21p. (ANL-4745(p.73-93))

Progress is reported in studies of the effects of x rays and nitrogen mustard on growth of the ciliate, Tetrahymena geleii, changes in blood plasma of the chick following x irradiation; the effects of x irradiation on enzymogenesis in postdiapause grasshopper embryos, the purification of labeled indoleacetic acid, and the radiosensitivity of auxin biosynthesis in bean plants. In a study of x radiation toxicity in the chicken, the mature chicken showed no response to variation of x-radiation dose rate similar to that reported in newly-hatched birds. Survival data for chickens of different ages given 1000 r of x irradiation are presented in tabular form. Effects of photoperiod and temperature on the movement of the flowering stimulus, and light-dark relationships of Xanthium are summarized and the effect of photoperiod on floral and fruit development in the red kidney bean are discussed. Data on biological effects of exposure of Paramecium aurelia to a nitrogen mustard compound revealed that, over the period of a year during which the experiments were performed, at equivalent doses death after autogamy increased and suppression of division decreased, while the death rate before cell division remained about the same. An investigation of the mechanism of inactivation of yeast alcohol dehydrogenase by x irradiation indicates the -SH groups are oxidized by the OH and O_2H radicals produced after irradiation of H_2O.

4693

Argonne National Lab.

PHYSIOLOGICAL CHEMISTRY, PHYSICAL CHEMISTRY, PHARMACOLOGY, THEORETICAL BIOLOGY, AND BIOPHYSICS, p.94-126 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT, NOVEMBER, DECEMBER, 1951, JANUARY, 1952. Austin M. Brues, ed. [nd] 33p. (ANL-4745(p.94-126))

In studies on the distribution of fixed C in rats and mice, it was determined that fixed C distribution differs considerably from that reported after isotope exposure of less than two week's duration. Data on the physiological status of bone carbonate, determined by isotopic turnover studies, indicate that the carbonate heterogeneity lies in the bone salt and that carbonate recently exchanged in vivo is more susceptible to removal by chemical and physical agents than older carbonate. Sulfosalicylic acid in doses of 30 and 40 mg caused 80 to 100% survival in acutely Be-poisoned mice, while a dose of 20 mg gave partial protection. Data on the tissue distribution of aurin tricarboxylic acid in rats and dogs at times varying from 1 hr to 6 months after injection are presented. Data from studies of the causes of postirradiation hypotension and development of a quantitative theory of the effects of ionizing radiations on the growth and steady states of tissues and organisms are summarized. A formula relating the maximum pulse heights of a layer fast-neutron detector to the energy of the incident neutrons and to the thickness of the scintillating layers is discussed. Light-absorption curves made on some terphenyl-xylene scintillating solutions are presented. Methods of measurement for fast neutrons in biological systems are reviewed, and a proposed calorimetric dosimeter is discussed.

4694

Atomic Energy Project, Western Reserve Univ.

MONTHLY PROGRESS REPORT APRIL, 1952, by Hymer L. Friedell. [nd] 6p. (NYO-1646)

Splenectomized rats were exposed to 655 r of x radiation. The thirty-day mortality was 45% and that of normal controls was 35%. Data from this study indicate that individual rats possess widely different degrees of sensitivity toward bartonellosis and that radiation can reduce the established immunity of the splenectomized rat to Bartonella muris. No predominant role of bartonellosis influencing survival following x irradiation of rats was noted. Studies of the effect of sub-total hepatectomy on the sensitivity of the rat to colloidal Au^{198} confirm conclusions that the hepatotoxic action of colloidal Au^{198} is not a significant component of its acutely lethal action. A technique is reported for measuring the radioactivity in a rat's tail as an index of the clearance of colloidal Au^{198} from the blood. A study of the N metabolism in rats given lethal doses of whole-body x radiation indicates that animals which receive x radiation have a substantially greater negative N balance than can be accounted for on the basis of starvation alone. The level of x irradiation best suited for studying the inhibition of nucleic acid synthesis in chick embryos was determined, and 700 to 800 r proved to be an LD_{50} dose.

4695

Atomic Energy Project, Univ. of Rochester

QUARTERLY TECHNICAL REPORT, JANUARY 1, 1952 THRU MARCH 31, 1952, by Henry A. Blair. May 14, 1952. 72p. (UR-205)

Separate abstracts have been prepared on the following sections of this report: Interim Report on Two-Year Experimental Inhalation Studies of $BeSO_4$ at a Level of 4 μg Be/m^3, and Excretion of Radium by Dogs after a Single Intravenous Injection, p.3-7; Studies on the Quantitative Separation of Protein-Bound Iodine from Iodide, and The Prevention of X-irradiation-Induced Hyperglycemia in Rabbits by Means of Insulin, p.11-30; Protection of the X-irradiated Dog with External Abdominal Shielding, and Preliminary Report on some Clinical Features of the Radiation Syndrome Complicated by Induced Infection, p.31-47; Studies Relative to the Phagocytic Activity of Leukocytes in Irradiated Dogs, and Effect of Rutin on the X-irradiated Dog, p.48-59; A Method for Complete Extraction of Embedding Material from

Tissue Sections for The Electron Microscope, and a New Microtome for Thin-Sectioning for Electron Microscopy, p.60-71.

4696
Atomic Energy Project, Univ. of Rochester
INTERIM REPORT ON TWO-YEAR EXPERIMENTAL INHALATION STUDIES OF $BeSO_4$ AT A LEVEL OF 4 μg Be/m^3, AND EXCRETION OF RADIUM BY DOGS AFTER A SINGLE INTRAVENOUS INJECTION, p.3-7 of QUARTERLY TECHNICAL REPORT, JANUARY 1, THRU MARCH 31, 1952, by Henry A. Blair. May 14, 1952. 5p. (UR-205(p.3-7))

The first year (50 weeks) of the proposed two year $BeSO_4 \cdot 6H_2O$ mist exposure, at a desired concentration of 4 μg Be/m^3 has been completed. The over-all, spectrographically determined concentration for the first year was 3.8 μg Be/m^3, with an extreme range of 2.1 to 8.8 μg Be/m^3. The animal data do not indicate any positive results with the possible exception of the rat groups. The mortality of exposed rat group (86%) was slightly higher than that of the control rat group (64%). Two adult dogs received 50 μc radium as an intravenous injection. Daily urine and fecal samples were collected and analyzed. It was found that dogs excreted respectively, 45.7 and 46.5 per cent of the dose during the first 10 days. (auth)

4697
Atomic Energy Project, Univ. of Rochester
STUDIES ON THE QUANTITATIVE SEPARATION OF PROTEIN BOUND IODINE FROM IODIDE, AND THE PREVENTION OF X-IRRADIATION INDUCED HYPERGLYCEMIA IN RABBITS BY MEANS OF INSULIN, p.11-30 of QUARTERLY TECHNICAL REPORT, JANUARY 1, 1952 THRU MARCH 31, 1952, by Henry A. Blair. Mar 14, 1952. 20p. (UR-205 (p.11-30))

Citrated plasma obtained from a patient on the fourth and fifth days after administration of 10 mc I^{131} for hyperthyroidism has been used to study the separation of protein-bound iodine from iodide. The data indicate 93% (σ = 3) of the plasma activity to be due to labeled PBI. Separation of proteins by dialysis, or by precipitation with cold 5 to 15% trichloracetic acid, with acid $ZnSO_4$ + NaOH, with $CuSO_4$ + NaOH, or with $CuSO_4$ + Na_2WO_4 results in no appreciable loss in PBI. Precipitation with $ZnSO_4$ + NaOH, with Na_2WO_4 + H_2SO_4 or with trichloracetic acid at room temperature appears to be incomplete. The most satisfactory separation of PBI from iodide is by dialysis. Iodide is easily removed from the trichloracetic acid precipitate by washing with cold 4 to 10% trichloracetic acid, but after four washings the loss of PBI amounts to approximately 8%. There is little loss of PBI when the $Zn(OH)_2$ or $CuWO_4$ precipitates are washed with water, but after four washings some 10% of added iodide remains. The hyperglycemia produced in rabbits by whole-body x irradiation reaches a maximum in about 4 hours after the start of the irradiation. For a dose of 2000 r the plasma glucose, which is normally about 130 mg per cent, is elevated on the average to a value of 320 mg per cent with occasional values over 500 mg per cent. When regular insulin is injected subcutaneously, 5 units at the start of the irradiation and 5 units more in 3 hours, the rise in plasma or cell glucose is prevented from occurring in practically every instance. Smaller amounts of insulin are sufficient to prevent the hyperglycemia for lower doses. (auth)

4698
Atomic Energy Project, Univ. of Rochester
PROTECTION OF THE X-IRRADIATED DOG WITH EXTERNAL ABDOMINAL SHIELDING, AND PRELIMINARY REPORT ON SOME CLINICAL FEATURES OF THE RADIATION SYNDROME COMPLICATED BY INDUCED INFECTION, p.31-47 of QUARTERLY TECHNICAL REPORT, JANUARY 1, 1952 THRU MARCH 31, 1952, by Henry A. Blair. May 14, 1952. 17p. (UR-205(p.31-47))

Sixteen adult dogs that were survivors of 525 r of 1-Mev x irradiation were exposed 3 months later to 525 r of 250-kv x irradiation. One-half of the dogs had their entire abdomen shielded with ⅛-inch lead during exposure. None of the shielded dogs died, while all of the control dogs were dead by the 23rd day after irradiation. The WBC count fell in the customary fashion in the control dogs, but none of the shielded dogs developed WBC counts of less than 1500. It is evident that abdominal shielding will still protect a dog that has survived a previous LD_{50} of total body radiation. A preliminary study of the effects of induced sepsis and peritonitis in the radiated (LD_{50}) dog is presented. 100% of the animals infected died and the morbidity rate was very high. The WBC count, and hematocrit did not reflect the presence of infection. A high incidence of terminal unrestrained growth of bacteria in the blood stream occurred. The gross pathology of the animals with sepsis showed changes indistinguishable from those of the uncomplicated radiation syndrome except for the severe hemorrhages in the kidney cortex. This anatomic area was much more extensively involved than usual. The value of a prophylactic broad-spectrum antibiotic is discussed. (auth)

4699
Atomic Energy Project, Univ. of Rochester
STUDIES RELATIVE TO THE PHAGOCYTIC ACTIVITY OF LEUKOCYTES IN IRRADIATED DOGS, AND THE EFFECT OF RUTIN ON THE X-IRRADIATED DOG, p.48-59 of QUARTERLY TECHNICAL REPORT, JANUARY 1, 1952 THRU MARCH 31, 1952, by Henry A. Blair. May 14, 1952. 12p. (UR-205(p.48-59))

A convenient in vitro method of studying the phagocytic activity of leukocytes by incubation of whole heparinized blood with saccharated iron is described. Preliminary interpretation of studies relative to the phagocytic activity of leukocytes of irradiated dogs and irradiated dogs treated with Pyromen after exposure indicates that: (1) irradiation with 300 r produces a decrease in phagocytic activity of leukocytes one week after exposure, an effect not observed in Pyromen-treated dogs exposed to a like dose; (2) phagocytic activity returns to normal before the beginning of hematopoietic recovery as indicated by leukocyte counts; (3) and the magnitude and direction of post-exposure trends to the leukocyte counts are similar in the two groups of dogs. A group of 24 normal dogs were exposed to 450 r of 250-kv x irradiation. This dose has been producing a mortality of 60 to 70% in dogs in the laboratory. The dogs were divided into four groups of 6 animals each. Rutin therapy had no beneficial effects on the dogs in this study. (auth)

4700
Atomic Energy Project, Univ. of Rochester
A METHOD FOR COMPLETE EXTRACTION OF EMBEDDING MATERIAL FROM TISSUE SECTIONS FOR THE ELECTRON MICROSCOPE, AND A NEW MICROTOME FOR THIN-SECTIONING FOR ELECTRON MICROSCOPY, p.60-71 of QUARTERLY TECHNICAL REPORT, JANUARY 1, 1952 THRU MARCH 31, 1952, by Henry A. Blair. May 14, 1952. 12p. (UR-205(p.60-71))

A method for complete extraction of embedding material from butyl methacrylate embedded sections for the electron microscope is described. The extraction is carried out in the microscope by electron bombardment at high beam intensities made possible by removing the condenser aperture. Little or no distortion due to the method of extraction is observed. Extraction is not the result of simple heating but may be due to a depolymerization resulting from electron bombardment. Shrinkage normal to the section occurs and

is greater in some tissue components than in others. It is suggested that this observation may make possible an estimate of the relative water contents of different tissue components. A new microtome is described for the cutting of thin sections for the electron microscope. The specimen is mounted on an arm attached to a constantly rotating shaft. The advance mechanism for the knife consists of a stiff member supporting the knife which is bent by stretching a relatively flexible spring attached to it. Very reproducible motion is claimed. Ribbons with a thickness of less than 300 A have been obtained. (auth)

4701

Atomic Energy Project, Univ. of Rochester

SERUM AND URINARY FIBRINOLYTIC ACTIVITY RELATED TO THE HEMORRHAGIC DIATHESIS IN IRRADIATED DOGS, by J. Colgan, E. Gates and L. L. Miller. June 2, 1952. 26p. (UR-210)

Significant changes in the serum and urine fibrinolytic activity were observed in dogs dying of the hemorrhagic syndrome following large-dose whole-body irradiation. The fibrinolytic activity in the urine of the dogs dying with pulmonary hemorrhage as the main cause of death showed a precipitate rise 4 to 5 days before death. The fibrinolytic activity in the serum showed a similar rise. The fibrinolytic activity of the serum and urine in all surviving dogs approached control levels about the 24th day after irradiation. A total of eleven dogs were studied, 7 dying, 4 surviving. Whole-body irradiation ranging from 450 to 800 r was delivered from a fixed overhead 250 or 1000 kv source. The fibrinolytic activity of the serum was measured by a modification of Christensen's method (J. Clin. Invest. 28, 163 (1949)). The fibrinolytic activity of urine was measured according to the method of Ungar and Mist (J. Exptl. Med. 90, 39(1949)). A precipitate rise in fibrinolytic activity of urine may be directly related to impending pulmonary hemorrhage as the main cause of death after whole body irradiation. Pulmonary hemorrhage may be produced by an excess of the fibrinolytic enzyme activated by tissue activators at the local tissue site. (auth)

4702

EFFECT OF BETA RAYS ON THE SKIN AS A FUNCTION OF THE ENERGY, INTENSITY AND DURATION OF RADIATION. I. PHYSICAL CONSIDERATIONS. PREPARATION AND CALIBRATION OF BETA-EMITTING PLAQUES. F. W. Henriques, Jr. Lab. Invest. 1, 153-66(1952) Summer.

The radioactive isotopes selected to investigate the effects of beta radiation on the skin as a function of the energy and intensity of radiation and of the duration and time lapse after irradiation included S^{35} (0.17 Mev), Co^{60} (0.31 Mev), Cs^{137} (0.55 Mev), Y^{91} (1.53 Mev) and $Sr\text{-}Y^{90}$ (0.61 and 2.2 Mev). Plaques for cutaneous irradiation consisting of circular Al sandwiches, each containing a uniform radioactive deposit in its central 1 cm^2, were prepared. The radiation emitted from each plaque was measured in roentgen-equivalent-beta (reb) by means of a vanishing ion chamber. Both the radiation dosage of the surface of the skin and the percentile reduction in the dosage as the β particles penetrated the underlying tissue were computed for each isotope. (auth)

4703

EFFECT OF BETA RAYS ON THE SKIN AS A FUNCTION OF THE ENERGY, INTENSITY AND DURATION OF RADIATION. II. ANIMAL EXPERIMENTS. A. R. Moritz and F. W. Henriques, Jr. Lab. Invest. 1, 167-85(1952) Summer.

An investigation has been made of the effects of β radiation on porcine skin. The skin was exposed to β-emitting plaques containing S^{35} (0.17 Mev), Co^{60} (0.31 Mev), Cs^{137} (0.55 Mev), Y^{91} (1.53 Mev), and $Sr\text{-}Y^{90}$ (0.61 and 2.2 Mev). Three hundred and forty-four skin sites distributed among 27 animals received single exposures and were kept under observation for periods ranging between 10 min and 115 days, after which they were excised and examined microscopically. The pathologic changes produced in the skin of the pig by β radiation were classified according to the severity of the injury sustained. (auth)

4704

THE INCORPORATION OF METHIONINE S^{35} INTO THE PROTEINS OF JENSEN RAT SARCOMA CELLS AFTER IRRADIATION OF THE TUMOUR. Barbara E. Holmes and Lorna K. Mee. Brit. J. Radiology 25, 273-8(1952) May.

The uptake of methionine S^{35} into the histone and two other protein fractions of the Jensen rat sarcoma is not affected in any regular manner by irradiation with 2000 r x rays. It was already known that irradiation with this dose of x rays caused a 50% inhibition of deoxyribonucleic acid synthesis and in some cases the nucleic acid synthesis (with P^{32}) and the protein turnover (with methionine S^{35}) were investigated in the same animals. It could thus be confirmed that the effects of irradiation on the formation of protein did not correspond with its action on nucleic acid synthesis. (auth)

4705

REDUCTION OF THE X-RAY SENSITIVITY OF ESCHERICHIA COLI BY SODIUM HYDROSULFITE AND CERTAIN OTHER INORGANIC SULFUR COMPOUNDS. William T. Burnett, Jr., M. Laurance Morse, Arthur W. Burke, Jr., and Alexander Hollaender. J. Bact. 63, 591-5(1952) May.

It has been shown that the protection of Escherichia coli, strain B/r, against x radiation by sodium hydrosulfite ($Na_2S_2O_4$) is that protection expected from the removal of dissolved oxygen. The slight differences in the isoefficiency dose ratios, reported previously, between $Na_2S_2O_4$-treated and nitrogen-bubbled suspensions can be explained on the basis of efficacy of the two methods in removing dissolved oxygen. Certain other inorganic sulfur compounds which have the ability to remove oxygen from buffer solutions will also increase the survival of x- irradiated bacterial cells in suspensions. (auth)

4706

EFFECTS OF WHOLE BODY EXPOSURE TO IRRADIATION UPON SUBSEQUENT FERTILITY OF MALE RABBITS. R. L. Murphree, W. M. Whitaker, J. L. Wilding, and J. H. Rust. Science 115, 709-11(1952) June.

Results of a preliminary investigation of the effects of whole-body exposure of male rabbits to x rays upon their subsequent fertility when mated to normal females indicate that deleterious effects on the prenatal viability of the offspring occur when the male has been exposed to relatively low levels of radiation (100, 200, or 300 r). In view of the findings in this study, it is suggested that extreme caution should be exercised in the voluntary exposure of humans to ionizing radiation approaching this order of magnitude until further experimental evidence is available.

4707

THE ENERGY TRANSFER FROM IONIZING PARTICLES TO AN AQUEOUS MEDIUM AND ITS BEARING ON THE INTERPRETATION OF RADIOCHEMICAL AND RADIOBIOLOGICAL CHANGE. L. H. Gray. J. Cellular Comp. Physiol. 39, Suppl. 1, 57-74(1952) Mar.

Investigations of the dissipation of energy of ionizing particles in liquids are summarized. Studies of the effects of ionizing radiations on biological systems are reviewed, and interpretation of radiobiological data is discussed.

4708

THE INDIRECT ACTION OF IONIZING RADIATIONS ON AQUEOUS SOLUTIONS AND ITS DEPENDENCE ON THE CHEMICAL STRUCTURE OF THE SUBSTRATE. Walter M. Dale. J. Cellular Comp. Physiol. 39, Suppl. 39-55, (1952) Mar.

A survey is presented of recent experiments on the mode of action of ionizing radiations and the specificity of their effects. Modification of current concepts, based on studies of biologically active substances, such as enzymes and amino acids and their derivatives, are presented. The indirect action of ionizing radiations on aqueous solutions, and the dependence of this action on the chemical structure of the substrate, as applied to the effects of radiation on biological systems, is emphasized.

RADIATION HAZARDS AND PROTECTION

4709

Los Alamos Scientific Lab.

STRAIN SPECIFICITY OF THE THERAPEUTIC EFFECT OF SPLENIC TRANSPLANTS IN IRRADIATED MICE, by John B. Storer. [nd] 15p. (AECU-2095; LADC-1196)

Splenic and marrow transplants were made intraperitoneally into irradiated mice of two inbred and one non-inbred strains. The donor tissues were taken from the same strain, unrelated strains, and from rats and guinea pigs. In addition, splenic tissue from mice of various ages were tested for therapeutic effectiveness against total-body irradiation. Implantation of adult spleens was effective only when the donor belonged to the same inbred strain as the recipient. Adult spleens from donors belonging to the same non-inbred strain, from unrelated strains, or from different species were ineffective in reducing radiation mortality. Strain specificity was lost, however, when the donor mice were less than 10 days old. Marrow transplants were without effect in reducing radiation mortality in all the animals tested. (auth)

4710

Los Alamos Scientific Lab.

LACK OF EFFECT OF URINARY EXTRACTS FROM IRRADIATED SPLEEN-SHIELDED RATS ON SURVIVAL OF IRRADIATED MICE, by J. B. Storer, and J. E. Furchner. [nd] 8p. (AECU-2098; LADC-1195)

Extracts were prepared from the urine of totally irradiated and irradiated spleen-shielded rats by the method used by other investigators to obtain myeloid stimulating substances from human urine. These extracts, when injected into irradiated mice, did not increase survival. The data suggest that if a hormone is elaborated by the shielded spleen of irradiated rats it is either not excreted in the urine or is not extractable by the method used in this study. (auth)

4711

New York Univ.

STUDIES OF THORIUM X APPLIED TO HUMAN SKIN. II. COMPARATIVE FINDINGS OF THE PENETRATION AND LOCALIZATION OF THORIUM X WHEN APPLIED IN ALCOHOLIC SOLUTION, IN OINTMENT AND IN LACQUER VEHICLES, by Victor H. Witten, Milton S. Ross, Eleanor Oshry, and Vera Holmstrom. [nd] 22p. (AECU-2114)

Upon application to human skin of Th X in an ointment base or lacquer vehicle, radioautograms of skin sections demonstrated Th X and its disintegration products present in the epidermis, hair follicles, sweat ducts, and sweat glands. Mechanisms of penetration are discussed, and comparison is made with results of a previous study of the penetration in an alcoholic solution.

RADIOTHERAPY

4712

California Univ., School of Medicine

DEFINITIVE THERAPY OF HYPERTHYROIDISM WITH IODINE 131, by Earl R. Miller. June 9, 1952. 5p. (AECU-2099)

Conditions under which patients are accepted for I^{131}-therapy of hyperthyroidism, and a brief discussion of the course of the treatment are presented. Clinical results of the treatment of 100 cases of hyperthyroidism with I^{131} are reviewed.

4713

Atomic Energy Project, Univ. of Rochester

RELATIVE EFFECTS OF ALPHA, BETA, GAMMA, AND NEUTRON RADIATION; THE SIGNIFICANCE OF THESE DIFFERENCES IN RADIATION THERAPY, by William F. Bale. May 28, 1952. 21p. (UR-209)

This paper was presented as a part of the Radiobiology Panel program at the Second National Cancer Conference. The properties of nuclear radiations and of radiations available from various accelerators and piles are discussed with regard to their use in the treatment of cancer. Particular attention is paid to techniques based upon localization of boron in tumor tissue and use of a slow neutron beam to selectively radiate such tissue by means of the protons produced as a result of the neutron-boron interaction. Use of tissue specific antibodies is mentioned as a possible method for concentrating boron in neoplastic tissues. (auth)

TOXICOLOGY STUDIES

4714

Argonne National Lab.

THE EFFECT OF ADRENOCORTICOTROPHIC HORMONE ON TISSUE DISTRIBUTION AND TOXICITY OF BERYLLIUM, by M. R. White, A. J. Finkel, and J. Schubert. May 1952. 5p. (AECU-2111; UAC-578)

Adrenocorticotrophic hormone (ACTH) had no striking effect on the distribution or retention of radioberyllium, injected into mice with and without carrier beryllium sulfate, although it caused a statistically questionable decrease in retention of carrier-free radioberyllium. It also had no effect on the survival of mice acutely poisoned with beryllium sulfate. (auth)

4715

Atomic Energy Project, Univ. of Rochester

THE RELATION OF PARTICLE SIZE OF URANIUM DIOXIDE DUST TO TOXICITY FOLLOWING INHALATION BY ANIMALS – II., by Herbert B. Wilson, George E. Sylvester, Sidney Laskin, Charles W. LaBelle, James K. Scott and H. E. Stokinger. June 6, 1952. 25p. (UR-197)

In two separate experiments, rabbits and rats were exposed to inhalation of UO_3 at a concentration of 80 mg/m^3, 7 hours daily, 5 or 6 days weekly for 37 calendar days. In the first, the mass median diameter (MMD) of the chamber dust particles was 2.3 μ; in the second 0.5 μ. The dusts were produced by "atomizing" water suspensions of the particles, and precautions were taken to reduce, to negligible proportions, "fines" in the 2.3-μ study and hexavalent U in the 0.5-μ study. Greater toxicity of the 0.5-μ MMD particles was evidenced in the rabbit by slight retardation of growth, higher incidence of urinary protein, elevation of urinary amino acid N-creatinine ratios and of blood N.P.N. and by greater renal damage; in the rat by greater renal damage, retardation of growth, increase in lung weight and in apparent gross lung damage. Uranium in all tissues (lung, femur and kidney) of terminally sacrificed animals was

greater following inhalation of the 0.5-μ MMD dust than of the 2.3-μ dust. An unusual granulomatous reaction was observed in the lungs of two terminally sacrificed rabbits of the 0.5-μ study. These results are compared with those of two preliminary experiments, conditions of which differed from those of the current studies in only two important respects: in the earlier studies (a) the MMDs of the particles of the "above 1 μ" study were smaller (b) significant percentages of hexavalent U were present in the 0.5-μ dust. (auth)

TRACER APPLICATIONS

4716
Michigan State Coll.
THE METABOLISM OF FOLIAR APPLIED UREA. I. RELATIVE RATES OF $C^{14}O_2$ PRODUCTION BY CERTAIN VEGETABLE PLANTS TREATED WITH LABELED UREA, by O. N. Hinsvark, S. H. Wittwer, and H. B. Tukey. [nd] 13p. (AECU-2096)

The first step in the utilization of the nitrogen in urea applied to the leaves of plants presumably is hydrolysis by the enzyme urease giving NH_3 and CO_2. The comparative rate constants of the activity-time curves of the enzymatic hydrolysis of C^{14}-labeled urea applied to the leaves of cucumber, bean, tomato, corn, celery, and potato were determined by continuously monitoring the air and recording the accumulation of $C^{14}O_2$ in a closed system. The initial reaction rates for cucumber, bean, tomato, and corn, the leaves of which were found relatively intolerant to urea, were typically of zero order. With celery and potato plants having considerably more tolerance to foliar applied urea, the kinetics of the enzymatic hydrolysis of urea by the leaves were of first order. Equal molar concentrations of sucrose used in solution with urea and applied to the foliage of tomato plants significantly reduced the rate of urea hydrolysis. It is suggested that plants most easily injured by urea sprays are apparently those which have the highest urease activity, and the initial kinetics of the reaction are of zero order. Conduciveness toward urea injury is indicative of rapid hydrolysis and may denote rapid utilization. Hydrolysis as it occurs in the leaves of plants subsequent to foliar applications of urea appears to be equivalent to utilization. (auth)

4717
Michigan State Coll.
ABSORPTION OF NUTRIENTS BY STEMS AND BRANCHES OF WOODY PLANTS, by H. B. Tukey, R. L. Ticknor, O. N. Hinsvark and S. H. Wittwer. [nd] 6p. (AECU-2097)

Absorption of nutrients by the stems and branches of woody plants was demonstrated by measuring the uptake of K^{42} as K carbonate applied in a 6-in. band of cotton gauze around dormant branches of bearing apple and peach trees, the uptake of P^{32} ortho-phosphoric acid by dormant 2-year old peach and apple trees, and measurements of the hydrolysis of urea from applications of C^{14} urea made to the branches in full leaf of apple, peach, and cherry trees.

4718
Oregon Univ. Medical School
TIME COURSE OF LIPIDE LABELING IN THE INTACT MOUSE AND RAT, by J. T. Van Bruggen, T. T. Hutchens, C. K. Claycomb, and Edward S. West. [nd] 16p. (AECU-2108)

The time course of lipide and CO_2 labeling following a single intraperitoneal injection of a tracer amount of acetate-1-C^{14} has been described. In mice, maximum incorporation into fatty acids and cholesterol fractions occurred before 30 minutes. No progressive change was seen up to 8 hours. Rats showed maximal incorporations in fatty acid and cholesterol fractions of either total-body lipides or of lipides of skin, liver, gut, carcass, and brain plus spinal cord in less than 21 minutes. Significant changes from these maxima during the following 3 to 4 hours were not observed. No evidence was found for the presence of a rapidly metabolizing fatty acid fraction in liver or in the total animal. (auth)

4719
Virginia Univ. Medical School
GLYCOLYSIS AND PHOSPHATE TURNOVER IN THE HUMAN ERYTHROCYTE, by D. R. H. Gourley. [nd] 17p. (ORO-72)

The addition of iodoacetic acid or sodium fluoride in concentrations which reduce the rate at which phosphate ions are taken up by human erythrocytes to about one-fifth of the normal rate decreased the concentration of adenosine triphosphate to about 10% of the level in normal blood at the end of 3 hr. The turnover of both the labile and stable P of ATP was significantly reduced by each inhibitor. These facts are interpreted as support for the hypothesis that inorganic phosphate normally enters the erythrocyte by the formation of ATP at the cell membrane. Iodoacetic acid reduced both the concentration of 2,3-diphosphoglyceric acid and the turnover of P in this compound. Sodium fluoride had no statistically significant effect on the concentration of 2,3-DPGA but depressed the turnover of P in this fraction. These effects were interpreted as additional evidence that 2,3-DPGA is an integral part of the glycolytic cycle of the erythrocyte. (auth)

4720
Virginia Univ., Medical School
THE ROLE OF ADENOSINE TRIPHOSPHATE IN THE TRANSPORT OF PHOSPHATE IN THE HUMAN ERYTHROCYTE, by D. R. H. Gourley. [nd] 28p. (ORO-73)

The concentration of phosphate in several acid-soluble organic P compounds in human erythrocytes has been determined. The turnover of radioactive phosphate in several acid-soluble organic P compounds of human erythrocytes has been studied in vitro over an 8-hr period under conditions such that the net movement of inorganic P is from the plasma into the cells. The experimental data are consistent with the hypothesis that phosphate enters the erythrocyte by formation of adenosine triphosphate on the cell membrane. Although no other organic P compound meets the conditions necessary for being a precursor of cell inorganic P, the possibility that some inorganic P diffuses into the cells is not excluded. (auth)

4721
Atomic Energy Project, Univ. of Rochester
L-HISTIDINE-2-C^{14}, ITS SYNTHESIS AND SOME ASPECTS OF ITS METABOLISM IN RATS, by Milton Toporek. June 11, 1952. 90p. (UR-203)

A method for the synthesis of L-histidine-2-C^{14} is described. Studies of certain aspects of its metabolism in the intact normal and cirrhotic rat and the isolated perfused normal and cirrhotic rat liver are reported.

4722
Atomic Energy Project, Univ. of Rochester
TETRAPYRROL PRECURSORS OF PROTOPORPHYRIN IX; I. UROPORPHYRIN III, by K. Salomon, J. E. Richmond, and K. I. Altman. May 19, 1952. 12p. (UR-208)

The preparation of C^{14}-labeled uroporphyrin is described. Conversion of uroporphyrin to protoporphyrin in bone marrow suspensions to the extent of 62% was demonstrated.

The occurrence of uroporphyrin as a natural constituent of normal rabbit bone marrow was established.

4723
RADIOACTIVE MATERIALS IN ENTOMOLIGICAL RESEARCH. Arthur W. Lindquist. J. Econ. Entomol. 45, 264-70(1952) Apr.

The possibilities of the use of radioactive materials in entomological research, the nature of the problems involved, and results obtained in connection with recent research are discussed. Suggestions are made for initiation of studies in this field.

CHEMISTRY

4724
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
REPORT OF PROGRESS AND EXPENDITURES JULY 1, 1951 TO JUNE 30, 1952 AND PROPOSALS FOR THE COMING FISCAL YEAR. [nd] 71p. (AECU-2082)

Studies are reported on the following: complex ions of fission elements, the chemistry of cerium and indium, photometry, determination of silver and samarium, polarography, separation of rare elements, carbonium ion rearrangements, organic scintillators, solvent extraction studies, ion exchange studies, fission process studies, and general nuclear chemistry.

4725
Argonne National Lab.
ELECTROLYTIC REDUCTION OF PERRHENATE. II. STUDIES IN SULFURIC ACID, by Philip Wehner and J. C. Hindman. June 1952. 21p. (AECU-2110; UAC-579)

Depending on the acid concentration and the potential used, perrhenate may be cathodically reduced to Re(V) or Re(IV) in sulfuric acid. These lower states are not obtained in solution but as suspensions, frequently colloidal in nature. Reductions in concentrated acid give indications of the formation of an unstable Re(VI) state. The action of oxygen on Re(V) and Re(IV) suspensions in dilute sulfuric acid produces violet-colored true solutions that may be reduced to amber solutions. The oxidation states of the rhenium in these solutions differ by one-half unit. Though it has not yet been possible to identify definitely the actual oxidation states, preliminary results indicate the amber is a Re(V) species and the violet a mixed Re(V)-Re(VI) species. (auth)

4726
Argonne National Lab.
ELECTROLYTIC REDUCTION OF PERRHENATE. I. STUDIES IN PERCHLORIC, ETHANESULFONIC, TRIFLUORACETIC AND HYDROCHLORIC ACIDS, by J. C. Hindman and Philip Wehner. May 1952. 20p. (AECU-2112; UAC-577)

Perrhenate solutions are reduced cathodically in trifluoracetic or ethanesulfonic acids to insoluble oxide deposits. Perchloric acid is catalytically reduced at a cathode in the presence of perrhenate. In the presence of rhenium a mercury cathode is depolarized with consequent hydrogen evolution in both trifluoracetic and hydrochloric acids. Conditions are given for the preparation of pure Re(IV) and Re(V) solutions in hydrochloric acid. Absorption spectra of these oxidation states in hydrochloric acid are given. Equilibria between the complex species present in hydrochloric acid solutions of Re(V) are rapidly established but only slowly in Re(IV) solutions. Re(V) can be quantitatively oxidized to perrhenate in hydrochloric acid while Re(IV) cannot. (auth)

4727
General Electric Research Lab.
THE SELF-DIFFUSION OF LIQUID MERCURY, by R. E. Hoffman. June 1952. 13p. (SO-2021; RL-693)

This report describes the measurements of the rate of self-diffusion in liquid Hg by the capillary technique and discusses the various theories for correlating self-diffusion and viscosity coefficients.

4728
Radiation Lab., Univ. of Calif.
GASEOUS HYDRATED OXIDES, HYDROXIDES, AND OTHER HYDRATED MOLECULES (thesis), by Guy R. B. Elliott. June 1952. 56p. (UCRL-1831)

Gaseous hydrated oxides which are more volatile than the corresponding oxides are discussed and the periodic table is covered for evidence of such molecules. The solubility of salts in high pressure steam is discussed and interpreted. The results are applied to steam turbine deposits and geological theory. (auth)

4729
ISOTOPIC COMPOSITION OF OXYGEN IN THE CATALYTIC DECOMPOSITION OF HYDROGEN PEROXIDE. Malcolm Dole, DeForest P. Rudd, Gordon R. Muchow, and Charles Comte. J. Chem. Phys. 20, 961-68(1952) June.

The isotopic composition of oxygen liberated in the catalytic decomposition of hydrogen peroxide using MnO_2, Fe_2O_3, colloidal gold, metallic platinum, and soluble catalase as catalysts has been measured. All the catalysts except catalase produced a measurable fractionation of the oxygen isotopes in the case of complete decomposition. A few rate experiments were also carried out, and the kinetics studied from the standpoint of isotope separation as a function of fraction of hydrogen peroxide decomposed. It is demonstrated that none of the liberated oxygen comes from the substrate water or from the potassium permanganate when hydrogen peroxide is oxidized. Observed fractionation factors are somewhat smaller than the maximum values calculated on the basis of Bigeleisen's equations. A minimum in the O^{18} percentage of the evolved oxygen in the case of the catalase experiments suggests that two mechanisms are operative for this type of catalysis. The initial enhancement of the O^{18} percentage of the evolved oxygen over that in the peroxide remains unexplained. (auth)

ANALYTICAL PROCEDURES

4730
Argonne National Lab.
DETERMINATION OF THALLIUM BY RADIOACTIVATION; APPLICATION TO POTASSIUM IODIDE, by C. J. Delbecq, L. E. Glendenin, and P. H. Yuster. June 25, 1952. 12p. (AECU-2103; UAC-592)

A neutron activation method for the determination of very small quantities of Tl in potassium iodide has been developed. This method should be applicable, with modifications in the chemical procedure where necessary, to the determination of Tl in other materials. As little as 10^{-7} g of Tl can be determined. (auth)

4731
Argonne National Lab.
A MICROMETHOD FOR THE SIMULTANEOUS DETERMINATION OF TOTAL CARBON AND CARBON 14, by P. V. Harper and K. A. Lathrop. Argonne National Lab. and Univ. of Chicago. Apr. 1952. 8p. (AECU-2105; UAC-584)

A simple rapid microdetermination for carbon in organic samples is described, which is particularly applicable in conjunction with C^{14} measurements. The useful range of the determination is 0.2 to 5.0 mg of C, and the recoveries on samples containing 1 mg of C were 100.2 ± 1.3%.

4732
Argonne National Lab.
A METHOD FOR THE DETERMINATION OF CALCIUM 40 AND CALCIUM 45 IN BIOLOGICAL MATERIAL, by William P. Norris and Blanche J. Lawrence. June 1952. 10p. (AECU-2113; UAC-593)

A method is described for the determination of Ca^{45} followed by assay of the same specimen for stable Ca^{40}. Ca is precipitated as the oxalate from solutions of the ash of biological material.

4733
Geological Survey
A THEORETICAL TREATMENT OF THE ABSORPTION CHARACTERISTICS OF THE DITHIZONE MIXED-COLOR SYSTEM, by Robert G. Milkey. May 1952. 12p. (TEI-236)

The equation of the standard curve used in the colorimetric determination of trace amounts of metals by means of dithizone extraction is developed, and a further expression is derived which defines the slope of the standard curve. These equations are used to show the relative effect and importance of the different factors that enter into the construction of the curve. The equations are further utilized to calculate a numerical value for the slope of the standard curve when lead is the metal determined. When this numerical value is compared with that for the slopes of curves determined experimentally, the close correlation of values shows that the interfering factors which may be present are not of sufficient significance to affect the analysis. (auth)

4734
EXTRACTION OF BISMUTH IODIDE COMPLEXES AS A SPOT TEST FOR BISMUTH. Philip W. West, Paschoal Senise, and Jack K. Carlton. Anal. Chim. Acta 6, 488-92 (1952) June. (In English)

The extraction of BiI_3 in the presence of excess iodide ions by methyl isobutyl ketone has been studied as a spot test for Bi. Interferences have been prevented through the use of hypophosphorous acid and oxalic acid, or by preliminary treatments. The test, as performed in the extraction pipet, is sensitive to 1 μ of Bi, with Pt and Pd constituting the only interferences. (auth)

4735
ANALYTICAL APPLICATION OF THE ABSORPTION SPECTRA OF THE HALIDE COMPLEXES OF HEAVY METALS. I. SPECTROPHOTOMETRIC DETERMINATION OF IRON WITH HYDROCHLORIC ACID. M. A. Desesa and L. B. Rogers. Anal. Chim. Acta 6, 534-41(1952) June. (In English)

A survey of the absorption spectra of the ions of several heavy metals in HCl has been made. Characteristic absorption spectra were obtained for trace amounts of V(V), Cr(III), Fe(III), Cu(II), Hg(II), Sn(IV), Pb(II), and Bi(III) in 6.7M HCl. As an example of the possible analytical applications of these spectra, the determination of trace amounts of Fe was thoroughly investigated. (auth)

4736
PHOTOMETRIC DETERMINATION OF BERYLLIUM IN BERYLLIUM-COPPER ALLOYS. C. L. Luke and Mary E. Campbell. Anal. Chem. 24, 1056-7(1952) June.

A method for the photometric determination of Be in 2% Be-Cu alloys has been developed using ethylenediaminetetraacetic acid as a complexing agent. The complexing agent prevents interference from moderate quantities of Cu, Al, Zr, Ti, Mn, Fe, Co, Ni, and Zn.

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

4737
PERIODIC SYSTEM OF THE ELEMENTS. W. de Groot and C. J. Bakker. Nederland. Tijdschr. Natuurk. 18, 113-14 (1952) May. (In Dutch)

The distinctive feature of the periodic table presented is the representation of natural isotopic abundances by the relative lengths of parallel lines on a scale.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4738
A MINIATURE CRYSTALLIZING UNIT. Dan McLachlan and and Carl J. Christensen. Rev. Sci. Instruments 23, 306 (1952) June.

An all-glass crystallizer that requires only 100 cc of solution, can be taken apart for cleaning, and accepts additions of solid material or rejects solvent without stopping the operation is described. In actual trials this small crystallizer has produced crystals of common material of 5-mm dimension in 1 hr, rejecting all crystals less than 4 mm.

DEUTERIUM AND DEUTERIUM COMPOUNDS

4739
MASS-SPECTROGRAPHIC DETERMINATION OF THE IONIZATION POTENTIAL OF HEAVY AMMONIA ND_3. H. Neuert. Z. Naturforsch. 7a, 293-4(1952) Mar.-Apr. (In German)

The following uncorrected potentials were found by extrapolating the ionization curves to zero ion intensity: NH_3, 11.30 ± 0.022 v; ND_2H, 11.47 ± 0.023 v; ND_3, 11.52 ± 0.027 v. Reproducibility considerations showed that the ND_3-HN_3 and ND_2H-NH_3 differences were 0.22 ± 0.05 and 0.17 ± 0.04 v, respectively. Taking the potential for NH_3 given by Mann et al. (Phys. Rev. 58, 340(1940)) as 10.5, the values for ND_3 and ND_2H become 10.72 ± 0.04 and 10.67 ± 0.04, respectively.

4740
APPLICATION OF A FLOAT METHOD TO RAPID MEASUREMENT OF D_2O CONCENTRATION IN AN AQUEOUS SOLUTION OF HEAVY WATER. E. Cerrai, C. Marchetti, and M. Silvestri. Nuovo cimento (9) 9, 530-4(1952) June. (In Italian)

A float method for determining heavy-water concentration in water samples of low D_2O content (a few mole per cent) is described. This method needs no calibration by samples of known D_2O content. (auth)

4741
MEASUREMENT OF THE DEUTERIUM CONCENTRATION IN CONDENSED WATER VAPOR OF A BORACIFEROUS SOFFIONE AT LARDERELLO. E. Cerrai, C. Marchetti, and M. Silvestri. Nuovo cimento (9) 9, 511-16(1952) June. (In Italian)

Heavy-water concentration of the Larderello (Tuscany) natural water vapor has been measured by a float method. In order to raise the precision, the sample was previously enriched in an electrolytic cell, whose separation factor had been calibrated by Milan tap water, before and after the enrichment of the Larderello sample. Assuming the D_2O concentration in the former as 0.015%, the Larderello water-vapor concentration was $0.0149 \pm 0.0006\%$ D_2O. (auth)

4742
HYDROGEN ISOTOPES IN STEAM WELLS. G. Boato, G. Careri, and G. G. Volpi. Nuovo cimento (9) 9, 539-40(1952) June. (In English)

Although the steam from the soffioni of Lardarello, Tuscany, is neither enriched nor depleted in D_2O, a mass-

spectrographic determination of HD/D_2 in the elementary hydrogen present showed an average value of 0.79 ± 0.05. This depletion could be accounted for by a single diffusion separation ($(^3/_4)^{1/2} = 0.82$) by some porous material in the earth or by the exchange equilibrium $H_2O + HD = HDO + H_2$ at 600 ± 100°C.

4743

INFRARED SPECTRA OF PEPTIDES IN HEAVY-WATER SOLUTION. Henri Lenormant and Jacques Chouteau. Compt. rend. 234, 2057-9(1952) May 19. (In French)

The infrared absorption spectra of di-, tri-, and tetrapeptides are simpler in D_2O solution than in the solid state; characteristic bands of various groups present in the molecule are easily identified. Spectra of N-ethylchloroacetamide, diglycine, triglycine, tetraglycine, acetylglycine, N-ethyglycinamide, and glycine are shown and discussed.

FLUORINE AND FLUORINE COMPOUNDS

4744

Pennsylvania State Coll.

CONCERNING THE BEHAVIOR OF AQUEOUS THENOYLTRIFLUOROACETONE, by Edward H. Cook and Robert W. Taft, Jr. June 7, 1952. 10p. (NYO-3374)

The principle species in an aqueous solution of trifluorothenoylacetone (TTA) is the keto hydrate ($TTA \cdot H_2O$). The titration of an aqueous (acidified or neutral) solution of TTA with aqueous sodium hydroxide results in the cleavage of $TTA \cdot H_2O$ to thenoylacetone and the salt of trifluoroacetic acid, caused by local concentrations of base. However, when aqueous TTA is added to the buffer solution of pH 8, $TTA \cdot H_2O$ is converted to enolate ion. The complete conversion of TTA to enolate in strongly basic solution has been accomplished only by adding solid anhydrous TTA to the solution of base. Back-titration of enolate ion obtained in this way, gave an apparent pK_a for aqueous TTA of 4.2×10^{-7} at 25°C. (auth)

GRAPHITE

4745

THERMAL AND ELECTRICAL CONDUCTIVITIES OF CARBON MATERIALS. S. Mizushima. Phys. Rev. 86, 1040 (1952) June 15.

Specimens of pitch coke (0.5% ash) were prebaked at 1300°C, and then each sample was heated in an electric furnace at different temperatures from 1500 to 2700°C for 20 min. The curves for the thermal conductivity and for the crystallite size in the hk0 direction are nearly parallel to each other, and both show a rapid rise with temperature of heat-treatment, even in the region where the electrical conductivity remains constant. The curve for the electrical conductivity appears to correspond to that representing the temperature dependence of the crystallite size in the hkl direction. After heating at temperatures in the range 1500 to 1900°C, solid carbon samples prepared from pitch coke, formaldehyde resin, or charcoal showed nearly the same and constant resistivity: 3.6, 3.6, and 2.3 ohm/cm (in the fiber direction).

MOLECULAR STRUCTURE

4746

Minnesota Univ.

THE POTENTIAL FUNCTION OF ETHYLENE, by Bryce L. Crawford, Jr., John E. Lancaster and Richard G. Inskeep. June 1, 1952. 19p. (NP-3949)

The infrared spectrum of asym-$C_2H_2D_2$ has been obtained, and the vibrational frequencies have been used to complete the calculation of the force constants of C_2H_4. The spectra of C_2H_3D, trans-$C_2H_2D_2$, and a mixture of cis- and trans-$C_2H_2D_2$ also were observed and used to check the force-constant calculations. (auth)

4747

FORMULA FOR THE VIBRATION FREQUENCY OF DIATOMIC MOLECULES OF THE ALKALI METALS. G. Lovera. Nuovo cimento (9) 9, 442-4(1952) May.

A simple expression in terms of atomic mass and interatomic distance for the vibration frequency of diatomic molecules is derived. Values calculated for Li_2, Na_2, K_2, Rb_2, Cs_2, LiK, LiRb, LiCs, NaK, NaRb, NaCs, and RbCs are tabulated and compared with published experimental data.

RADIATION EFFECTS

4748

Tracerlab, Inc.

CHEMICAL SYSTEMS SENSITIVE TO RADIATION; MONTHLY REPORT NO. 4 [FOR] OCTOBER 1, 1951–OCTOBER 31, 1951. Oct. 31, 1951. 18p. (NP-3945; Monthly Report No. 4; U20006)

The effects of γ radiation on both organic and inorganic solutions of various monomers were investigated. Of the solutions investigated acrylonitrile in water at pH of ~1.5 was most sensitive to radiation and most stable to light and heat. Experimental procedures for the incorporation of pH indicators in halogenated plastics are reported. Irradiation of organic solutions of four metal aryls and tetraethyl lead indicate insufficient decomposition for these five compounds to be of value for dosimetric purposes. Several organic chelating agents that detect ferric ion colorimetrically in the presence of ferrous ion were investigated for possible utility in a dosimeter but none were found to be completely satisfactory.

4749

MECHANISM OF SCINTILLATION IN SOLUTIONS. M. Ageno and R. Querzoli. Nuovo cimento (9) 9, 282-90(1952) Mar. (In Italian)

A source of fluorescent radiation, intensive enough to be photographed, has been made by immersing into a 0.5% solution of terphenyl in xylene a Po source of α particles. From a set of photographs of such a source in different experimental conditions, a direct experimental proof has been carried out for the first time: (a) of energy transport through a range of some millimeters, into a scintillating solution excited by high-energy radiations; and (b) of the excitation-energy transfer from solvent to solute. It has also been demonstrated that this energy transfer is effected, at least partially, by radiation. (auth)

4750

LUMINESCENCE OF SOLUTIONS DUE TO EFFECTS OF γ RAYS AS STUDIED BY MEANS OF A 931A PHOTOMULTIPLIER. A. Ciccone. Nuovo cimento (9) 9, 36-44(1952) Jan. (In Italian)

Luminescence of crystalline anthracene, naphthalene, and acenaphthene and of their xylene solutions exposed to Ra γ rays was studied with respect to concentration. Qualitative explanations of the luminescence mechanism are discussed.

SEPARATION PROCEDURES

4751

Oak Ridge National Lab.

THE DETERMINATION OF OXYGEN IN SODIUM, by J. C. White, W. J. Ross, and R. Rowan, Jr. Apr. 30, 1952. Decl. July 10, 1952. 26p. (AECD-3416; ORNL-1286)

A method has been developed for the determination of sodium monoxide in sodium which depends upon the reaction between sodium and n-butyl bromide in hexane solution. The sodium monoxide does not react with the reagent and can be determined, after the addition of water, by titration.

The method is comparatively rapid, requires only the simplest of equipment, and it has the advantage that both oxygen and other impurities can be determined on the same sample. (auth)

4752
Horizons, Inc.
TECHNICAL PROGRESS REPORT [FOR] THIRD AND FOURTH QUARTERS [COVERING PERIOD] DECEMBER 1, 1951 TO MAY 31, 1952 [ON] THE PRODUCTION OF ZIRCONIUM BY FUSED SALT ELECTROLYSIS, by Merle E. Sibert and Morris A. Steinberg. June 18, 1952. 28p. (NYO-3118)

Further work toward development of the double fluoride process for production of zirconium electrolytically is disclosed. Emphasis in this phase of the work has been placed on expansion and modification of the electrolytic cells. A modified cell has been designed, and two of the units have been completed. This cell allows for greater flexibility of operation and will provide for expanded efforts on the process. Design of the cell is fully described. Some physical testing and metallographic work has been carried out on arc-melted specimens and is also reported. Extensive analytical work and screen analysis has also been done. A complete summary of this data is given in the following sections of this report. (auth)

4753
Syracuse Univ.
FRACTIONATION OF SOME RARE EARTH PAIRS BY PRECIPITATION FROM HOMOGENEOUS SOLUTION, by Louis Gordon and Kenneth J. Shaver. May 22, 1952. 18p. (NYO-3554)

This study of the fractionation of rare earths complexed with ethylenediaminetetraacetic acid was undertaken to develop an improved procedure. Results obtained with some rare-earth pairs of the cerium group in the presence of the complexing agent are compared with those obtained by the methyl oxalate fractionation procedure. A comparative study was also made of the separation of the cerium and yttrium groups using these two rare earths as a prototype. This work makes it feasible to determine when the complexing agent might be most useful in rare-earth fractionations and how it might be used most effectively. (auth)

SPECTROSCOPY

4754
Cryogenic Lab., Ohio State Univ.
A NOTE ON THE VIBRATIONAL FREQUENCIES AND THE ENTROPY OF DECABORANE, by W. E. Keller and H. L. Johnston. Apr. 16, 1952. 14p. (NP-3876; TR-328-16; U22324)

Infrared and Raman spectra of $B_{10}H_{14}$ in CS_2, and the infrared spectrum of solid $B_{10}H_{14}$, were determined in order to obtain crystal and molecular structure data for comparison with those obtained by x-ray-diffraction studies. The 66 fundamental frequencies were roughly classified, and the expected frequency range for each type of vibration was estimated. The results agree qualitatively with the x-ray analyses of Kasper, et al., (Acta. Cryst. 3, 436(1950)). Calculation of the entropy of gaseous $B_{10}H_{14}$ at 298.16°K and 1 atm., based on the fundamental frequencies obtained from the spectrographs and the molecular parameters from the x-ray diffractions, yielded 83.91 E.U., which compared favorably with the 87.41 E.U. obtained by thermodynamic measurements. (NRS abst.)

4755
THE APPEARANCE POTENTIAL OF C^+ IN THE MASS SPECTRA OF SOME SUBSTITUTED METHANES AND THE HEAT OF SUBLIMATION OF CARBON. Herman Branson and Carter Smith. J. Chem. Phys. 20, 1047(1952) June.

A study is being made of the mass spectra of series of C compounds. The initial results on C^+ in the mass spectra of CH_4, CH_3Cl, CH_3Br and CH_3I seem to favor 5.885 ev as the heat of sublimation of C.

4756
INFRARED SPECTRAL DATA AND TENTATIVE ASSIGNMENTS FOR CF_3Br AND CF_3I. Paul R. McGee and Forrest F. Cleveland. J. Chem. Phys. 20, 1044(1952) June.

Wave numbers were obtained and the relative intensities were estimated of gaseous CF_3Br and CF_3I in the region 400 to 2200 cm^{-1} with a Beckman IR-2 spectrophotometer having KBr optics. The two compounds were prepared by the bromination or iodination of CF_3COOAg.

4757
THE INFRARED ABSORPTION SPECTRA OF CIS- AND TRANS-1,2-DICHLOROHEXAFLUOROCYCLOBUTANE. John R. Lacher, Alfred Büchler, and J. D. Park. J. Chem. Phys. 20, 1014-15(1952) June.

The thermal dimerization of chlorotrifluoroethylene leads to 1,2-dichlorohexafluorocyclobutane consisting mainly of the high boiling isomer. On the other hand, the photochemical or catalytic chlorination of hexafluorocyclobutane yields a dichloride consisting mainly of the low boiling isomer. These isomers may be readily separated by fractional distillation. Dielectric constant measurements permit one to indicate that the high boiling one is cis and the low boiling is the trans. The infrared spectra in the sodium chloride region were measured and compared with the existing data on the Raman spectra. (auth)

SYNTHESES

4758
National Bureau of Standards
LACTOSE-1-C^{14} AND LACTOBIONIC-1-C^{14} DELTA LACTONE. A STUDY OF THE CYANOHYDRIN SYNTHESIS ON 3-β-D-GALACTOSYL-ARABINOSE, by Harriet L. Frush and Horace S. Isbell. June 30, 1952. 17p. (NBS-1752)

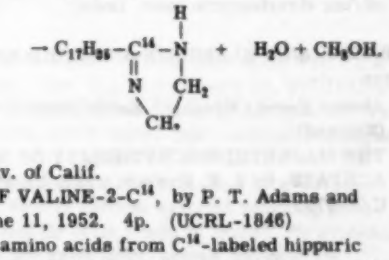
A method for the preparation of high-activity 1-C^{14}-labeled lactose in good yield by means of a cyanohydrin synthesis on 3-galactosyl-arabinose is described.

4759
Oak Ridge National Lab.
THE SYNTHESES OF 2-TRIFLUOROACETO(ACETYL-1-C^{14})-THIOPHENE AND 2-(HEPTADECYL-1-C^{14})-IMIDAZOLINE; PART I, by Vernon F. Raaen and Gus A. Ropp and PART II, by Vernon F. Raaen, O. Kenton Neville, and Gus A. Ropp. Issued July 14, 1952. 9p. (ORNL-1288)

2-Trifluoroaceto(acetyl-1-C^{14})-thiophene has been prepared in 67% yield from sodium acetate-1-C^{14}. 2-(Heptadecyl-1-C^{14})-imidazoline [2-(heptadecyl-1-C^{14})-glyoxalidine] having a millimolar activity of 727 μc was prepared in 80% yield from stearic acid labeled with C^{14} in the carboxyl group according to the following equations:

$$C_{17}H_{35}C^{14}OOH + CH_2N_2 \rightarrow C_{17}H_{35}C^{14}OOCH_3 + N_2$$

$$C_{17}H_{35}C^{14}OOCH_3 + H_2NCH_2CH_2NH_2$$



$$+ H_2O + CH_3OH.$$

4760
Radiation Lab., Univ. of Calif.
THE SYNTHESIS OF VALINE-2-C^{14}, by P. T. Adams and B. M. Tolbert. June 11, 1952. 4p. (UCRL-1846)

The synthesis of amino acids from C^{14}-labeled hippuric acid has been used satisfactorily in the case of the aromatic

amino acids (Wang, Hummel, and Winnick, J. Am. Chem. Soc. 74, 2445(1952)), but has not previously been reported in the preparation of aliphatic compounds. Using procedures similar to those employed in the aromatic series, a novel preparation of valine has been developed. By means of the following reactions, we have prepared valine-2-C^{14} in 65% yield from glycine-2-C^{14}. The method is also readily adaptable to a synthesis of valine-1-C^{14}.

$$H_2NC_{14}H_2CO_2H \xrightarrow{C_6H_5COCl} C_6H_5\text{-}CONHC^{14}H_2CO_2H \xrightarrow{(CH_3)_2CO}$$

$$(CH_3)_2C = C^{14}(N)(C=O)(C-C_6H_5) \xrightarrow[HI]{P_4} (CH_3)_2CHC^{14}(NH_2)CO_2H.$$

2-Phenyl-4-isopropylidine-(oxazalone-4-C^{14})-5. Glycine-2-C^{14} (120 μc, 0.76 g) was converted to hippuric-2-C^{14} acid by reaction with benzoyl chloride (Organic Synthesis, Coll. Vol. II, John Wiley & Sons, New York, 1943 p.328). The product was ground to a fine powder with 0.6 g of freshly fused sodium acetate and dissolved in 35 ml of dry acetone. Acetic anhydride (5 ml) was added dropwise and the mixture heated under reflux for 15 hours (Ramage and Simonsen, J. Chem. Soc. 534-35(1935)). The hot solution was poured onto crushed ice and diluted to 250 ml with water. The precipitate was collected by filtration and dried in vacuo. The yield of oxazalone (m.p. 98 to 100°) was 1.16 g (71 μc) or 59% from glycine-2-C^{14}. The filtrate contained 36 μc (30%), of which 28 μc (23%) could be recovered as pure glycine.

Valine-2-C^{14}. The oxazalone was mixed with 2.0 g of red phosphorus and 12.5 ml of acetic anhydride. Hydrogen iodide (12.5 ml, specific gravity 1.7) was added and the solution was heated under reflux for 20 hours. The reaction mixture was filtered and the filtrate evaporated to dryness in vacuo. The residue, dissolved in 100 ml of 70% ethanol, was poured through a glass column containing 60 ml of Dowex-50 cation exchange resin (50-100 mesh) in the acid form. The resin was washed free of anions by rinsing with 100 ml of 70% ethanol followed by 250 ml of water. The amino acid was eluted from the resin with 250 ml of 2N ammonium hydroxide followed by 250 ml of water. The eluate was evaporated to dryness on a steam bath and dried in vacuo. The resulting valine-2-C^{14} (50 μc) was shown to be free from radioactive or amino acid contaminants by two-dimensional paper chromatography and radioautography (Benson, et al., J. Am. Chem. Soc. 72, 1710(1950)). The yield was 83% from the oxazalone, or 65% from unrecovered glycine-2-C^{14}. (Entire report)

4761

MICROBIOLOGICAL SYNTHESIS OF C^{14}-LABELED STREPTOMYCIN. E. O. Karow, R. L. Peck, C. Rosenblum, and D. T. Woodbury. J. Am. Chem. Soc. 74, 3056-59(1952) June.

Radioactive streptomycin was prepared by microbiological synthesis using S. griseus as the active microorganism. Glucose and starch, uniformly labeled with C^{14}, were added to the medium as precursors in separate experiments. Glucose was the superior substrate since it appeared to be preferentially utilized for streptomycin formation. Radiostreptomycin was isolated as the crystalline helianthate. The specific activity of the product was ≃ 0.01 to 0.025 μc/mg streptomycin base. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

4762

Atomic Energy Research Establishment, Harwell, Berks (England)

THE MAGNETIC SUSCEPTIBILITY OF SODIUM PLUTONYL ACETATE, by J. K. Dawson. Feb. 22, 1952. 5p. (AERE-C/R-876)

The magnetic susceptibility of sodium plutonyl acetate has been measured over the temperature range 90 to 300°K. It follows the Curie law exactly and the susceptibility agrees with the theoretical spin-only value for two unpaired electrons. This is taken as evidence that the ground state of the plutonyl ion has a $6d^2$ electron configuration. (auth)

URANIUM AND URANIUM COMPOUNDS

4763

Carbide and Carbon Chemicals Co. (K-25)

SOLUBILITY OF URANIUM TETRAFLUORIDE IN WATER, by H. A. Bernhardt, J. H. Junkins and S. S. Kirslis. Issued June 15, 1949. Decl. with deletions June 30, 1952. 11p. (AECD-3412; K-422)

The solubility of uranium tetrafluoride in oxygen-free water was determined at two temperatures. At 25.0°C the molality of a saturated solution was $1.03 \pm 0.03 \times 10^{-4}$ and at 40.2°C was $1.94 \pm 0.03 \times 10^{-4}$. The differential heat of solution calculated from these molalities was 7700 calories per mole. At 40.2°C the molality of a saturated solution in hydrochloric acid solution of pH 4.0 was $2.05 \pm 0.03 \times 10^{-4}$ and in hydrochloric acid solution of pH 2.0 was $7.79 \pm 0.04 \times 10^{-4}$. (auth)

WASTE DISPOSAL

4764

Vitro Corp. of America

INTERIM SUMMARY DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT (24-A4); JOB 24; PERIOD SEPTEMBER 1, 1950–MARCH 1, 1952. June 6, 1952. 51p. (KLX-1374)

A laboratory scale unit has been developed to adsorb and concentrate dilute low activity solutions with ion exchange resins. The unit permits safe and efficient disposal of radioisotopes from such solutions. (auth)

4765

Vitro Corp. of America

BI-MONTHLY PROGRESS REPORT MARCH - APRIL, 1952; DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT. June 26, 1952. 4p. (KLX-1376)

Performance during field tests is reported for a laboratory waste-disposal unit. Adjustments based on information obtained during the field tests are discussed. No design data are included.

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

4766

Iowa State Univ. Graduate Coll.

THE SEPARATION OF GASES BY MEANS OF POROUS MEMBRANES (thesis), by Howard E. Huckins, Jr. and Karl Kammermeyer. Aug. 1951. 53p. (AECU-2117)

Following a brief literature survey of work done on the flow of gases through porous media and separation of gases by means of porous membranes, report is made of experiments in which porous glass was used as the membrane. Separation experiments were made with the following mixtures: H_2-CO_2, H_2-O_2, H_2-N_2, and H_2-O_2-CO_2. Experimentally determined permeabilities were found to deviate from expected behavior, presumably because of adsorbed flow, or mobility of an adsorbed layer of gas. Molecular, or Knudsen, flow was found to be the main method of transport. The separation that was obtained with mixtures of gases agreed fairly well with calculations made using the experimental values of

permeability, even though the ratio of experimental permeabilities differed from the theoretical ratio of molecular weights. The use of a form of Weller's equation (Bur. of Mines Report No. 3333: Q-152(1949)) was found not to describe fully the phenomenon of gas separation by porous media. On the basis of these experiments, porous glass was shown to be a very efficient medium for the separation of gases.

4767
Lewis Flight Propulsion Lab., NACA
METHOD FOR CALCULATION OF HEAT TRANSFER IN LAMINAR REGION OF AIR FLOW AROUND CYLINDERS OF ARBITRARY CROSS SECTION (INCLUDING LARGE TEMPERATURE DIFFERENCES AND TRANSPIRATION COOLING), by E. R. G. Eckert and John N. B. Livingood. June 1952. 71p. (NACA-TN-2733)

A method which permits approximation of local heat-transfer coefficients in the laminar-flow region around cylinders of arbitrary cross section from those for wedge-type profiles is extended to include the effects of large temperature differences and transpiration cooling. Charts prepared from exact solutions of the laminar boundary-layer equations for wedge-type profiles which allow for these effects yield results with a minimum of calculation. Application of the method to circular and elliptic transpiration-cooled cylinders is made to determine local heat-transfer coefficients and surface temperatures and to determine the variation in coolant flow required for maintaining a constant surface temperature. (NACA abst.)

4768
Lewis Flight Propulsion Lab., NACA
TWO-DIMENSIONAL SHEAR FLOW IN A 90° ELBOW, by James J. Kramer and John D. Stanitz. June 1952. 44p. (NACA-TN-2736)

As part of an approach to a better understanding of the motion of real fluids in flow machinery, two-dimensional, incompressible, nonviscous shear flows in a 90° elbow have been investigated. Solutions are presented for linear and sinusoidal velocity distributions across the inlet of the elbow. The solutions with linear inlet velocity distributions indicate that as the negative vorticity of the flow increased: (1) the static-pressure drop through the elbow decreased, (2) the local deceleration along the outer channel walls increased, and (3) the magnitude of the velocities on the channel walls changed greatly, but the local pressure coefficient rose only gradually and the difference in pressure coefficient at corresponding points on the two walls was practically unchanged. In the case of a sinusoidal inlet velocity distribution, local decelerations occurred on both walls. (auth)

4769
A TYPE OF TURBULENT NONHOMOGENEOUS FLOW. Jean Bass. Compt. rend. 234, 2256-7(1952) June 4. (In French)

The general structure and local form of spatiotemporal correlations in an incompressible turbulent flow, nonhomogeneous in a direction λ, homogeneous in the directions perpendicular to λ, having symmetry of revolution about λ, and stationary are studied.

4770
THE EFFECT OF HOMOGENEOUS TURBULENCE ON MATERIAL LINES AND SURFACES. G. K. Batchelor. Proc. Roy. Soc. (London) A213, 349-66(1952) July 8.

A material line consisting always of the same particles of fluid is lengthened by the convective action of turbulent motion, at a rate which is shown to be exponential at a sufficient time after the initial choice of the line. The area of material surface elements also increases exponentially, although with a different exponential coefficient. It is then a consequence of conservation of mass of the fluid that the normal distance between two neighboring parallel material surfaces decreases at an exponential rate which is simply related to the rate at which material lines lengthen. These kinematical results are relevant to the convective action of the turbulence on the distribution of two kinds of local property of the fluid, viz. quantities, represented by θ, of which the total amount in a material volume of the fluid remains constant (e.g., mass density of a foreign substance), and quantities, represented by F, of which the total flux across a material surface remains constant (e.g., vorticity). F is proportional, at all times, to the vector representing a material line element and $G_i = \nabla\theta$, is proportional to the vector representing a material surface element, and hence they both increase exponentially in time. The last two sections of the paper are concerned with the combined effect on F and G of convection and molecular diffusion, and a condition for the effect of the convection to be dominant is obtained. In the case of F, convection is found to be dominam if the appropriate molecular diffusivity is small compared with the kinematic viscosity of the fluid, and F^2 will then increase indefinitely, unless some additional effect comes into play (as it does in the case of magnetic field strength). In the case of G, convection will be dominant if the initial distribution of G has a large enough length scale; the effect of the convection is to decrease this length scale so that ultimately the two effects reach an equilibrium. The length scale of the ultimate distribution of G, as obtained herein, is different from that put forward recently by Obukhoff. (auth)

MATERIALS TESTING

4771
New York Univ.
A STUDY OF POISSON'S RATIO IN THE YIELD REGION, by George Gerard and Sorrel Wildhorn. Jan. 1952. 30p. (NACA-TN-2561)

The variation in Poisson's ratio from the elastic to the plastic value was studied experimentally by a systematic series of tests on several aluminum alloys. The tests were conducted under simple tensile and compressive loading along three orthogonal axes. A theoretical variation of Poisson's ratio for an orthotropic solid was obtained from dilatational considerations. The assumptions used in deriving the theory were examined by use of the test data and were found to be in reasonable agreement with experimental evidence. (NACA abst.)

RADIOGRAPHY

4772
MATERIAL TESTING WITH GAMMA AND BETA RADIATION. I. RADIOACTIVE MATERIALS AND THEIR PHYSICAL PROPERTIES. E. A. W. Müller. Arch. tech. Messen, 127-30(1952) June. (In German)

The natural and artificial radioactive nuclides suitable for radiographic purposes are listed, together with energies of their β and γ rays, availability of sources, specific activity of such sources, and fields of application. 49 references.

VACUUM SYSTEMS

4773
MODIFICATION OF STEAM VALVES FOR HIGH VACUUM USE. P. F. Yergin. Rev. Sci. Instruments 23, 310(1952) June.

Modifications for high-vacuum use of bronze gate valves of the nonrising-stem, solid-wedge type, originally designed for steam at 125 to 300 lb pressure, are illustrated. The valves have been used on both the high- and fore-vacuum parts of all-metal kinetic vacuum systems reaching pressures of 2×10^{-7} mm Hg (with liquid N_2 traps). No evidence of leakage through the valve body, across the gate, or around the stem seals has ever been observed.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

4774

Battelle Memorial Inst.

A REVIEW OF SILICON CARBIDE, by C. G. Harman and W. G. Mixer, Jr. June 3, 1952. 46p. (BMI-748)

Information is compiled concerning silicon carbide and silicon carbide products, exclusive of abrasives. The information assembled here was selected from the published literature. A digest is presented of the chemical, physical, structural, and mechanical characteristics of silicon carbide. Data typifying the characteristics of refractories and refractory bodies based on silicon carbide are presented. (auth)

4775

THE SYSTEM BERYLLIA-ALUMINA-TITANIA: PHASE RELATIONS AND GENERAL PHYSICAL PROPERTIES OF THREE-COMPONENT PORCELAINS. S. M. Lang, C. L. Fillmore, and L. H. Maxwell. J. Research Natl. Bur. Standards 48, 298-312(1952) Apr.

Extensive revisions in the published phase diagrams of the $BeO-Al_2O_3-TiO_2$ system and its components are shown to be necessary. New data are presented. Experimentally determined physical and ceramic properties of porcelains of this system are reported.

CORROSION

4776

Argonne National Lab.

WATER CORROSION OF STRUCTURAL MATERIALS; OCTOBER, 1948–JUNE, 1951, by C. R. Breden, S. Greenberg, R. M. Robinson, A. H. Roebuck, V. F. Saitta and C. C. Scott. July 15, 1951. 198p. (ANL-4519)

A program of evaluating the corrosion resistance of materials considered for use in high-temperature water systems has been undertaken. Results of laboratory corrosion tests completed by Argonne and its subcontractors before June 1, 1951, on structural materials other than zirconium are presented. The materials studied include stainless steels, carbon steels and other ferrous alloys, cobalt alloys, nickel and nickel alloys, copper and copper alloys, other metals and alloys, and ceramic bodies. The tests were carried out, for the most part, in high-pressure autoclaves. Of the materials tested, the austenitic stainless, plus the precipitation hardening stainless steels, and high-cobalt alloys were found to be the most satisfactory in 500°F oxygenated water. (auth)

4777

Metals Corrosion Lab., Bureau of Mines

CORROSION STUDIES ON TITANIUM AND ZIRCONIUM METALS; MONTHLY REPORT FOR MAY 1952, by L. B. Golden, W. L. Acherman and W. Mace. [nd] 8p. (NP-3893)

Six-day tests at 35°C in concentrations of air-aerated H_2SO_4 solutions ranging from 5 to 50% resulted in distinct differences in the relative corrosion rates of arc-melted Ti and metal prepared by powder-metallurgy techniques. An unsuccessful attempt is reported to reduce or eliminate the embrittlement of Zr caused by solutions of ferric or cupric chlorides by the addition of K nitrate. Results of galvanic corrosion studies on Ti and Zr metals are reported.

GEOLOGY AND MINERALOGY

4778

DETERMINATION OF THE RATIO OF ATOMIC CONCENTRATIONS OF THORIUM AND URANIUM IN MINERALS BY X-RAY EMISSION SPECTROGRAPHY. Madeleine Tournay. Compt. rend. 234, 2527-9(1952) June 23. (In French)

The Th $L_{\beta 1}$ and U $L_{\beta 2}$ rays are sufficiently close to be compared directly. No Pb ray interferes. When Th and U minerals are used as anticathodes, the Th/U concentration ratio can be determined between 9 and 0.03. Exposure time is between 5 and 20 min, and each determination requires 2 to 3 mg. The maximum relative error is 5%, but this may be as low as 1 to 2%. A densitometer curve is shown.

4779

ARGON ISOTOPES IN NATURAL GASES. G. Boato, G. Careri, and M. Santangelo. Nuovo cimento (9) 9, 44-9 (1952) Jan. (In English)

The isotopic composition of A has been measured in many Italian fumaroles and soffioni. A remarkable enrichment of A^{40} has been found, certainly due to the K^{40} decay in the interior of the earth. With the help of these data, the problem of the origin of atmospheric A is considered. (auth)

METALS AND METALLURGY

4780

Institute of Engineering Research, Univ. of Calif.

FUNDAMENTALS OF GLASS TO METAL BONDING. II. WETTABILITY OF SOME GROUP I AND VIII METALS BY SEVERAL SODIUM SILICATE GLASSES; SECOND TECHNICAL REPORT, by Victor F. Zackay, David W. Mitchell, Stephan P. Mitoff and Joseph A. Pask. Apr. 15, 1952. 27p. (AECU-2088)

This report is the second of a fundamental study on ceramic-metal bonds and presents experimental data on the wettability of a number of metals of Groups I and VIII—copper, silver, gold, nickel, palladium, and platinum—by a limited series of sodium silicate glasses. Effects of gas atmosphere, grain size of metal, and temperature on wettability were investigated. (auth)

4781

North American Aviation, Inc.

KINETICS OF ORDERING IN THE ALLOY AuCu, by G. J. Dienes. Issued Aug. 30, 1950. 36p. (NAA-SR-89)

The kinetics of ordering in AuCu has been studied using electrical resistivity as the index of order. A purely phenomenological analysis of isothermal resistivity-time curves showed that ordering in this alloy is a process with a single constant activation energy of 29 kcal. For further kinetic analysis, it is necessary to transform the raw data into isothermal order parameter-time curves. This was accomplished via a semi-theoretical relation between resistivity and the average degree of short range order (σ) and substantiated by agreement with available experimental information. A consistent kinetic picture was obtained in terms of σ with the ordering process accurately described by a simple third-order rate equation with all the kinetic constants fully evaluated. The usual ln(rate constant) versus 1/T plot gave an activation energy of 28.5 kcal in excellent agreement with the phenomenological activation energy. Further experiments showed that the proposed kinetics predict correctly the response to complex time-temperature sequences. Some of the uncertainties arising in the analysis are pointed out. Future work, designed to elucidate the disordering kinetics, and thereby the equilibrium degree of order-temperature relation, is briefly discussed. (auth)

4782

North American Aviation, Inc.

ORDER - DISORDER THEORY, by D. B. Bowen. Issued June 4, 1952. 32p. (NAA-SR-175)

An equilibrium theory of order-disorder has been developed that includes the effects of lattice oscillations on the ordering process. A unique method of transforming from the property measured to the order parameter, based

on the equilibrium theory, is shown. This transformation is particularly necessary in the treatment of kinetic data. A kinetic treatment of ordering and disordering is suggested that certainly resolves some, and may resolve all, of the ambiguities inherent in the use of the Bragg-Williams relaxation equation. Inferences are made concerning the reasons why some alloys exhibit only short-range order, why some exhibit both long- and short-range order and why some cannot be quenched to disorder. These reasons are all related to the effect of lattice oscillations on the kinetics of ordering. (auth)

4783
Institute of Engineering Research, Univ. of Calif.
SOME OBSERVATIONS ON CORRELATIONS BETWEEN THE CREEP BEHAVIOR AND THE RESULTING STRUCTURES IN ALPHA SOLID SOLUTIONS; NINETEENTH TECHNICAL REPORT, by Oleg D. Sherby and John E. Dorn. Apr. 15, 1952. 33p. (NP-3865; U22253)

Constant-load creep tests were performed on Al alloyed with either Mg or Cu in order to study the relationship between structures developed during creep and the physical variables of the creep test. A systematic correlation existed between the creep stress $\dot{\epsilon}_s e^{\Delta H/RT}$ and the microstructure at fracture, the correlation being independent of test temperature and secondary creep rate. This was substantiated by x-ray-diffraction photograms of the test samples. At temperatures above 400°K, the creep strain of α solid-solution alloys was a function of the temperature-modified time parameter $\Theta = \int e^{-\Delta H/RT}\, dt$, where ΔH is the activation energy (equal to about 35,000 cal/mole), R = gas constant, and T = absolute temperature. ΔH was relatively insensitive to test temperature, stress, grain size, small concentrations of alloying elements, and metallurgical structure. The failure of the mechanical equation of state for creep was attributed to the fact that each new creep stress yields a unique set of grain substructures as a function of the creep strain. (NRS abst.)

4784
Physical Metallurgy Lab., Calif. Inst. of Tech.
THE MARTENSITE TRANSFORMATION TEMPERATURE IN TITANIUM BINARY ALLOYS; THIRD TECHNICAL REPORT, by Pol Duwez. Apr. 1952. 14p. (NP-3879; U22249)

The temperatures which effect the martensite transformation from β-solid solution to α'-supersaturated-solid solution were determined for binary alloys of Ti and Nb, Ta, W, Fe, Cr, or Mn. In each case the β to α' transformation temperature decreased as the amount of alloying element soluble in β-Ti increased. Extrapolation of concentration values to zero on concentration-temperature curves indicated that the intercept with the vertical axis occurs in the temperature range corresponding to the transformation of pure Ti. Data from the literature are tabulated for critical concentrations of alloying element above which the β structure is retained after quenching. The critical concentration for retaining β-solid solution in Ti-Fe alloys is indicated as about 6%. (NRS abst.)

4785
Armour Research Foundation
EXPLORATION OF VANADIUM BASE ALLOYS; REPORT NO. 4 (FOURTH QUARTERLY REPORT); NOVEMBER 9, 1951–FEBRUARY 8, 1952. Feb. 29, 1952. 27p. (NP-3903; ATI-135688; Report No. 4)

Further information is reported on phase relationships in vanadium-base binary alloys. Hardnesses in as-cast and annealed states have been studied and correlated. On the basis of this information a deoxdiation practice has been proved useful in reducing the annealed hardness of certain important binary alloy systems. Hot forgeability has been demonstrated on a large number of alloys. A full program is under way to study the physical properties of these forged alloys. (auth)

4786
Armour Research Foundation
EXPLORATION OF VANADIUM-BASE ALLOYS; REPORT NO. 1 (FIRST QUARTERLY REPORT), by William Wilson, Jr. and M. Hansen. June 20, 1951. 13p. (NP-3904; ATI-105970; Report No. 1)

Observations on crushing, forging, pressing, and rolling V metal are summarized briefly. Microstructures of the variously worked V samples are illustrated. 7 figures.

4787
Tour, Sam and Co., Inc.
RESEARCH AND DEVELOPMENT OF METHODS OF VAPOR DEPOSITED COATINGS FOR TITANIUM AND TITANIUM ALLOYS; FINAL TECHNICAL REPORT, by Mohammed S. Hyder. Apr. 21, 1952. 33p. (NP-3906; WAL Report No. 401/48/B-10)

Experiments on pyrolysis of molybdenum hexacarbonyl for vapor deposited coatings on titanium were conducted. An adherent deposit of molybdenum was obtained using an H_2/CO ratio of approximately 2:1 at 930°F. Maximum hardnesses of the plate, as measured from Knoop and Vickers indentations, were found to be approximately three to four times that of the titanium base. An attempted diffusing treatment, at high temperature, resulted in excessive grain growth and recrystallization of the titanium and some loss of plate hardness. Other test runs, using different H_2/CO ratios and temperatures, yielded partially or completely non-adherent and non-uniform deposits. Photomicrographs, showing microstructures of the parent metal and the molybdenum plate, are included. The chemical nature of the deposit has not been ascertained. (auth)

4788
Armour Research Foundation
RESEARCH AND DEVELOPMENT TOWARD IMPROVING TITANIUM-ALUMINUM BINARY ALLOYS BY THE ADDITION OF A THIRD COMPONENT; INTERIM TECHNICAL REPORT NO. 1, SEPTEMBER 1–DECEMBER 31, 1951. [nd] 29p. (NP-3926; Interim Technical Report No. 1; U22482)

Work was directed to the addition of other elements to binary Ti-Al alloys in an effort to develop alloys of superior strength and toughness. Preliminary theoretical investigations indicated the selection of Mo and Cr additions. Alloy ingots of Ti and 2, 4, and 6% Al with addition of 2, 6, and 10% Mo or 2, 4, and 6% Cr were forged to 0.5-in.-diam. bars for tests. The ingots were prepared by melting Ti sponge and alloy components in a nonconsumable arc furnace, forging to 0.5-in. round electrodes, and remelting in a consumable-electrode arc furnace. A belt-type charging hopper to feed the material into the first furnace was built to provide control of the charge additions, to decrease splashing of the molten metal onto the crucible walls, and to produce more homogeneous ingots. Metallographic transformation-temperature determinations were made of the Ti-Al-Cr samples annealed for 1 hr at 800°, 850°, 900°, 950°, and 1000°C and water-quenched. Graphic presentation of the transformation temperature for each alloy series showed a decrease with increasing Cr addition. The β-α temperature was raised about 20°C for each per cent increase in Al for a given Cr content. Photomicrographs showed that the $\alpha + \beta$ structures of alloys quenched at 100°C or more below the transformation temperature were fine and nearly unresolvable. Those quenched near the transformation point were coarser; in some cases, only traces of α existed. The 2% Al-4% Cr alloy quenched from 900°C showed a transformation from β to acicular α which appeared to be classifiable as resulting from a martensitic-type reaction. The amount of retained β

in 4 or 6% Cr alloys appeared to increase with Al additions. (NRS abst.)

4789
Battelle Memorial Inst.
FIRST INTERIM REPORT ON A SURVEY OF THE LITERATURE ON HYDROGEN IN TITANIUM TO WATERTOWN ARSENAL, by G. A. Lenning, C. M. Craighead, and R. I. Jaffee. Apr. 1, 1952. 40p. (NP-3931)

A survey of the literature on the effects of H on the physical and mechanical properties of Ti is presented. 15 references.

4790
Battelle Memorial Inst.
SECOND INTERIM REPORT ON THE NATURE OF THE LINE MARKINGS IN TITANIUM AND ALPHA TITANIUM ALLOYS TO WATERTOWN ARSENAL, by C. M. Craighead, G. A. Lenning, and R. I. Jaffee. Apr. 15, 1952. 10p. (NP-3943)

The fine line markings in the microstructures of unalloyed Ti and α Ti alloys have been identified as a TiH phase. A sample of high-purity Ti rod containing 0.009 ± 0.001 wt. % H, was resistance-heated in a 0.05-μ vacuum for 4½ hr at 1500°C. During the early stages of heating, the pressure increased to 150 μ, indicating that gases were being evolved. Vacuum-fusion analysis showed 0.0006 ± 0.0003 wt. % H to be present. Metallographic examination of the vacuum-annealed rod showed no evidence of fine line markings, and no line markings were present in the vacuum-annealed rod after cold rolling. A sample of the vacuum-annealed rod was treated with H in a Sieverts-type absorption apparatus. The structure of the sample again showed markings similar in appearance to those observed in the original material. X-ray diffraction patterns on alloys containing 2.8 and 4.5 at. % H showed two phases: α Ti and a second phase identified as TiH. Solubility of H and of TiH in Ti is discussed. The chief mechanical-property effect of the insoluble hydride phase is the significant lowering of impact strength.

4791
Battelle Memorial Inst.
FIRST INTERIM REPORT ON THE EFFECT OF MICROSTRUCTURE ON THE MECHANICAL PROPERTIES OF TITANIUM ALLOYS TO WATERTOWN ARSENAL, by F. C. Holden, D. J. Maykuth, H. R. Ogden and R. I. Jaffee. Mar. 12, 1952. 45p. (NP-3944)

The effect of microstructure on the mechanical properties of high-purity Ti, the base for the alloy studies, is described. Tensile and flow properties, impact energy, and hardness were investigated and transition-temperature studies were made of impact energy in selected structures. Experimental techniques and testing equipment used on the project are described in detail.

4792
Armour Research Foundation
DEVELOPMENT OF PHASE EQUILIBRIUM DIAGRAMS FOR THE TITANIUM-RICH PORTIONS OF THE TERNARY SYSTEMS Ti-Mn-Al, Ti-Cr-Mo, AND Ti-Mn-Mo; INTERIM TECHNICAL REPORT NO. 2 [FOR] FEBRUARY 1, 1952–MAY 31, 1952. [nd] 24p. (NP-3947; Interim Technical Report No. 2)

For the Ti-Cr-Mo system, revised $\beta/\alpha + \beta$ phase boundaries at the 800, 750, and 700°C isothermal levels and new $\beta/\beta + \gamma$ phase boundaries at the 1100, 1000, 900, 800, and 700°C levels are shown. A number of vertical sections have been drawn from these data. A tentative parametric surface for the β phase in the Ti-Mn-Mo system has been constructed, and the major portion of the 1000°C isothermal for the Ti-Mn-Al system is presented.

4793
Carnegie Inst. of Tech.
GALLING AND SEIZING CHARACTERISTICS OF TITANIUM AND TITANIUM-BASE ALLOYS; INTERIM TECHNICAL REPORT NO. 1 [FOR] OCTOBER 15, 1951–APRIL 15, 1952. [nd] 15p. (NP-3948; Interim Technical Report No. 1)

The importance of real area of contact, normal load, roughness, adhesion, adsorbed films, and temperature in friction and seizing of metals in general are discussed. The results of crude tests on unlubricated Ti reveal that if galling has started on one surface, it does not take long for the other surface to follow suit. A machine designed for more informative tests is described. (auth)

4794
Massachusetts Inst. of Tech.
SOLID SOLUTIONS AND GRAIN BOUNDARIES; TECHNICAL PROGRESS REPORT NO. 10, SCOPE II, by B. L. Averbach, M. Cohen, P. A. Flinn, E. E. Underwood, W. F. Flanagan, P. S. Rudman and J. Hilliard. Mar. 31, 1952. 5p. (NYO-582; Technical Progress Report No. 10)

The energy changes involved in solid solution formation determine the thermodynamic stability of a solid solution in the macroscopic sense. Attempts have been made to describe the detailed atomic arrangements which the solution must take to be consistent with the thermodynamic properties. This program has been undertaken to obtain the necessary thermodynamic information and to measure directly the corresponding atomic arrangements by means of x-ray techniques in the same systems. The nickel-gold system is being studied in detail because of its suitability for both of these measurements. In addition, similar studies on the gold-iron, Al-Zn, Al-Ag, and Al-Cu systems are under way in order to round out the picture of solid solutions that undergo precipitation at lower temperatures. Preliminary measurements on the nature of grain boundaries in solid solutions are also being undertaken. Progress is briefly reported for these various studies but very little experimental data are included.

4795
Massachusetts Inst. of Tech.
FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION; TECHNICAL PROGRESS REPORT NO. 6, SCOPE III, by B. L. Averbach, M. Cohen, S. Allen, G. P. Conard, and P. Fopiano. Mar. 31, 1952. 4p. (NYO-861; Technical Progress Report No. 6)

The plastic deformation of metallic crystals and the changes which occur on annealing such crystals after deformation is being investigated. An x-ray method is used to measure the local atomic displacements produced in single crystals by cold work. The changes in these displacements are then observed after various annealing treatments. Another x-ray technique is used to measure the relative disorientations within the single crystals. It is thus possible to correlate such processes as plastic deformation, recovery, polygonization and recrystallization in terms of atomic displacements and local disorientations. These data are being supplemented with additional measurements of density, hardness, and electrical resistivity at low temperature. (auth)

4796
Pittsburgh Univ.
THERMODYNAMICS OF CRYSTALLINE SOLUTIONS; PROGRESS REPORT FOR APRIL 1, 1952 TO JULY 1, 1952, by W. E. Wallace, R. S. Craig, L. W. Coffer, D. A. Edwards and R. A. Flinn. July 7, 1952. 10p. (NYO-949)

Progress is reported in determination of the heat capacities of pure Mg between 10° and 325°K. The adiabatic compressibility of a Cd-Mg alloy containing 50.6 at. % Cd was

established by the velocity-of-sound method to be 2.11×10^{-6} atm^{-1}. Satisfactory operation is reported for an electrochemical cell suitable for studying Mg alloys down to 230°C. A preliminary interpretation of the asymmetry in the curve showing heat of formation versus composition for Cd-Mg alloys is given using the Brillouin zone structures of the pure metals. The same ideas are extended to account for the radically different crystallographic changes accompanying the development of the ordered structures in $MgCd_3$ and Mg_3Cd.

4797
MAGNETIC PROPERTIES OF NICKEL-LANTHANUM ALLOYS. J. Wucher. J. phys. radium 13, 278-82(1952) May. (In French)

Thermomagnetic study of the Ni-La system led to the following results. Starting from Ni, the two metals form a series of solid solutions up to 9 at. % La. However, there is a tendency to form Ni_5La at the expense of the solution. In the solution, the three valence electrons of La progressively occupy the vacancies in the 3d shell of Ni, thus causing the disappearance of ferromagnetism at 20 at. % La. The paramagnetic study of Ni_4La and Ni_3La showed that the Ni in these compounds has a considerable atomic moment; in solid solutions of the same composition all the vacancies are occupied and the moment is zero. Ni_4La and Ni_3La are unstable and apparently in equilibria with the alloy as follows: $A + Ni_5La = Ni_4La$ and $A + Ni_4La = Ni_3La$. The definite compound Ni_2La is pyrophoric; its magnetic susceptibility, $\chi = 3.16 \times 10^{-6}$, is invariant between 20 and 700°C, which seems to exclude antiferromagnetism. Addition of less than 25 at % does not appreciably change the susceptibility of La. For Ni with a completed electronic shell, an atomic susceptibility χ_A near 50×10^{-6} is deduced.

4798
EFFECT OF TEMPERATURE ON THE TENSILE PROPERTIES OF HIGH-PURITY NICKEL. William D. Jenkins and Thomas G. Digges. J. Research Natl. Bur. Standards 48, 313-21(1952) Apr.

Tension tests were made at temperatures ranging from –320° to 1,500°F on high-purity nickel in the annealed condition. Exceptions to the usual trend exhibited by metals of decreasing strength and increasing ductility with increasing test temperature were observed and discussed. Strain aging occurred in specimens tested in the temperature range of about 80° to 300°F, but recrystallization and recovery predominated in specimens fractured at 1,200° and 1,500°F. (auth)

4799
PARTICIPATION OF NITROGEN IN PROCESS OF HIGH-TEMPERATURE OXIDATION OF TITANIUM IN AIR. V. I. Arkharov and G. P. Luchkin. Doklady Akad. Nauk S.S.S.R. 83, 837-9(1952) Apr. 21. (In Russian)

The oxidation of Ti and Ti-Fe alloys in air and in O_2, at atmospheric and 160-mm pressures, respectively, were investigated by x-ray diffraction from 700 to 1200°C. A break in the oxidation curve appears at 840°C for Ti in air, but not in O_2. Above 1150°C, oxidation is more rapid in air than in O_2. The role of N in the mechanism of the progressive oxidation is discussed.

PHYSICS

4800
Pennsylvania Univ.
ANNUAL REPORT; PHYSICS OF METALS AND ALLOYS AT LOW TEMPERATURES. July 1, 1951. 39p. (AECU-2094)

The three reports NYO-645, NYO-646, and NYO-647 (NSA 6-2944, 6-2945, and 6-2947) have been bound together without change.

4801
Brookhaven National Lab.
CONFERENCE ON FISSION PRODUCT UTILIZATION [HELD ON] FEBRUARY 18-19, 1952. [nd] 49p. (BNL-171)

This report of the first conference held to investigate the possibilities of finding commercial use for fission products includes discussions of problems in chemical dosimetry, a calorimetric calibration of γ-ray actinometers, a methylene blue dosimeter, development of a polyvinyl film dosimeter, and crystal dosimetry. Progress is reported in studies of fission-product application. A brief review of results obtained at M. I. T. over the past six years on the applications of ionizing radiations to foods, drugs, and pharmaceuticals, the effects of γ radiation on bacteria, molds, yeasts, vitamins and enzymes, initiation of chemical reactions by radiation, and progress in industrial applications of intense γ radiation are discussed.

4802
Brookhaven National Lab.
QUARTERLY PROGRESS REPORT JANUARY 1 - MARCH 31, 1952; UNCLASSIFIED SECTION. [nd] 47p. (BNL-177)

Progress in the fields of physics, instrumentation and health physics, accelerators, chemistry, reactor science and engineering, biology, and medicine is reported chiefly by means of abstracts of talks and of articles which have received journal publication. Brief statements are made concerning new or incomplete experiments, but the only topic discussed at any length is Cosmotron testing and component development.

4803
Ames Lab.
PROGRESS REPORT IN PHYSICS FOR THE PERIOD JULY 1, 1951 TO DECEMBER 31, 1951, by G. W. Fox, J. F. Carlson, G. C. Danielson, D. E. Hudson, E. N. Jensen, J. K. Knipp, J. M. Keller, L. J. Laslett, S. Legvold, G. Miller and D. Zaffarano. May 1, 1952. 37p. (ISC-224)

Separate abstracts have been prepared for the following sections of this report: Radiation Studies, Studies of Nuclei, and Theoretical Physics, sects. II, III, and IV; and Solid State Physics, sect. V.

4804
Ames Lab.
SOLID STATE PHYSICS, sect.V of PROGRESS REPORT IN PHYSICS FOR THE PERIOD JULY 1, 1951 TO DECEMBER 31, 1951, by G. W. Fox, J. F. Carlson, G. C. Danielson, D. E. Hudson, E. N. Jensen, J. K. Knipp, J. M. Keller, L. J. Laslett, S. Legvold, G. Miller and D. Zaffarano. May 1, 1952. 13p. (ISC-224(sect.V))

Preliminary measurements of the Hall coefficient of Th at room temperature yield a value $R_H = -1.0 \pm 0.3 \times 10^{-4}$ cm^3/coulomb. Assuming a resistivity, r, of 18×10^{-6} ohm-cm, the mobility of the electrons in Th would be $R_H/r = 5.5$ (cm/sec)/(volt/cm). An electron-diffraction study of Th-gas reactions at the surface of Th metal has indicated a new Th nitride with a b.c.c. crystal structure. The relative absorption of light by thin red sputtered films of NaW bronze has been measured and the results are presented. Point-contact rectification in diamond has been demonstrated in both the counting and photoconducting characteristics. New results are given on the crystal structure, Hall coefficient, magnetic properties, Meissner effect, and latent heat of vaporization of rare-earth metals.

4805
X-RAY ABSORPTION CORRECTIONS FOR SINGLE CRYSTALS. Howard T. Evans, Jr. J. Applied Phys. 23, 663-68(1952) June.

It is shown in this paper that exact expressions may be derived for the absorption factor for the intensity of Bragg reflection by a small euhedral crystal completely bathed in a parallel x-ray beam. The expression is a sum of terms evaluated for subdivisions of the crystal determined according to discontinuities in boundary conditions imposed by the distribution of edges between the plane faces of the crystal. For a prismatic crystal of constant cross section, general expressions are derived for five general types of subdivisions in terms of the linear absorption coefficient and certain linear dimensions. Other expressions are also given for other types of subdivisions which arise in certain cases. The application of the method, including corrections for secondary extinction, is illustrated by calculations on tetragonal barium titanate. (auth)

4806
CHARACTERISTICS OF THE HIGH CURRENT TUNGSTEN ARC IN ARGON, HELIUM, AND THEIR MIXTURES. Merrill Skolnik and T. B. Jones. J. Applied Phys. 23, 643-52(1952) June.

An experimental study was made of the properties of the high current d-c electric arc in argon, helium, and their mixtures at atmospheric pressure. Tungsten-rod electrodes were used over a current range from 10 to 100 amperes. Measurements of the voltage-current and the voltage-electrode separation characteristics were made along with the plasma voltage gradients in both the pure gases and in the mixtures. It was found that this type of arc was very stable when the system was free from oxide impurities and that the cathodic processes played a major role in the arc mechanism. The results obtained suggest that the value of the anode voltage drop for the inert-gas arc over the current range studied is negligibly small. At the higher currents or with smaller diameter cathodes, tungsten was able to evaporate from the cathode in sufficient quantities to influence the character of the discharge. It was observed that the properties of the arc in mixtures of gases were in between the properties observed in the pure gases. The lower ionization potential gas, argon, had more effect on the properties of the arc in mixtures than did helium. As long as there was at least 15 percent argon present in the mixture, the arc properties and appearance were more like those observed in argon than in helium. (auth)

4807
FREQUENCY OR WAVELENGTH IN ROENTGEN ENERGY DISTRIBUTION DIAGRAMS. Bo Lindell. Acta Radiol. 37, 28-32(1952) Jan.

It is pointed out that the common way of representing the x-ray energy distribution gives the misleading impression that there is an energy maximum at about ½ the minimum wavelength. The author states that actually most of the energy is transferred by quanta of much greater wavelength, i.e., soft radiation, and that high-voltage x rays are not as easily compared with γ rays from radium as is often assumed.

4808
THE LIQUID-SOLID TRANSFORMATION IN HELIUM FROM 1.6° TO 4°K. C. A. Swenson. Phys. Rev. 86, 870-6(1952) June 15.

The transformation from liquid to solid helium behaves quite differently above and below the intersection of the λ-point-pressure curve with the melting-pressure curve. The experimental data given here extend previous work from below 1.8° to about 4°, and show the effect of the λ transformation on the latent heat of melting, the change in molar volume on melting, and the melting-pressure curve. When these data are combined with a new determination of the λ-point-pressure curve, the indication seems to be that the λ transformation is not truly of second order; that is, that it does not obey the Ehrenfest equations. (auth)

4809
GAMMA-RAY ABSORPTION COEFFICIENTS. Charlotte Meaker Davisson and Robley D. Evans. Revs. Modern Phys. 24, 79-107(1952) Apr.

A survey is given of the absorption of radiation in the energy range from 0.1 to 6 Mev. Results of the theories of Compton effect, photoelectric effect, and pair production are given in the form of equations, tables, and curves. Necessary considerations in studying absorption coefficients are discussed and results of various workers are compared with theory. It is concluded that in this energy range the present theories give values of absorption coefficients which are in good agreement with those obtained experimentally. (auth)

AEROSOLS

4810
Illinois Univ.
SOME ASPECTS OF THE PHYSICAL BEHAVIOR OF AEROSOL PARTICLES IN THE ATMOSPHERE, by W. E. Ranz and H. F. Johnstone. May 5, 1952. 18p. (AECU-2093)

Phenomena which are associated with the behavior of individual particles can be understood in terms of known physical concepts if factors which are insignificant by many orders of magnitude in normal experience are recognized to be significant in a scale of values reduced to the mass and size of an aerosol particle. The following topics concerning aerosol particles in the atmosphere are discussed in terms of known concepts with recognition of significant factors: (1) gross motion of aerosol particles caused by atmospheric turbulence, (2) forces which affect the motion of individual aerosol particles, (3) effect of the electric field in the atmosphere on the deposition of dust particles, (4) washout of dust particles by raindrops, (5) coagulation caused by thermal and turbulent motion as it affects the particle size of the atmospheric aerosol, and (6) decay and growth of aerosol particles. (auth)

4811
DETECTION AND MEASUREMENT OF AEROSOL PARTICLES BY THE USE OF AN ELECTRICALLY HEATED FILAMENT. Bernard Vonnegut and Raymond Neubauer. Anal. Chem. 24, 1000-5(1952) June.

Investigations in cloud physics indicated the need for an instrument to detect and measure certain types of aerosol particles. When a gas containing a suspension of vaporizable particles is rapidly drawn past a small electrically heated filament, a cooling effect is produced by the sudden evaporation of each aerosol particle that collides with the filament. The resultant cooling of a portion of the heated filament produces a momentary lowering of its electrical resistance which is a function of the heat required for vaporization of the particle. This change of resistance produced by the particle can be readily transformed into a voltage pulse. By electronic techniques, the pulses can be counted and analyzed to give information concerning the concentration of particles, particle size, and the mass concentration of the dispersed substance. (auth)

4812
ULTRAMICROSCOPIC OBSERVATION OF AEROSOLS. Pierre Tauzin. J. phys. radium 13, 38S-39S(1952) May. (In French)

The parallels between ultramicroscopy of aerosols and hydrosols, principles of cell construction for aerosol ultramicroscopy, measurement of diameter and electric charge of the particles, and orientation of nonspherical aerosols are discussed briefly.

COSMIC RADIATION

4813
SPECTRUM OF μ MESONS AT SEA LEVEL. D. Brini, O. Rimondi, and I. Filosofo. Nuovo cimento (9) 9, 504-10(1952) June. (In Italian)

The range differential spectrum of μ mesons has been determined at sea level between 1 and 3.5 bev/c in order to gain evidence of an anomaly it is supposed to present. From the results obtained the authors conclude that in this energy interval there are no irregularities greater than a few per cent. (auth)

4814
METHODS OF SOLUTION OF THE ELECTRON-PHOTON CASCADE EQUATIONS. F. Monticelli. Nuovo cimento (9) 9, 477-86(1952) June. (In Italian)

By using Laplace transformations, the diffusion equations of the shower theory are reduced to a Volterra integral equation, a solution of which is obtained by using the method of successive approximations. It is shown that this solution corresponds to Scott's (Phys. Rev. 80, 611(1950)). Further, it is shown that the same equation leads to the solution of Bhabha and Chakrabarty (Phys. Rev. 74, 1352(1948)). (auth)

4815
A METHOD OF INTERPRETING THE DISTRIBUTION IN MULTIPLICITY OF SHOWER SECONDARIES. John Linsley. Phys. Rev. 86, 1050-1(1952) June 15.

In interactions of fast charged cosmic-ray primaries with the nuclei of emulsions or cloud-chamber plates, the multiplicity n of shower secondaries can be found rather easily, and an integral distribution in n for the sample can be obtained. An integral equation, derived on the assumption that the fluctuations in multiplicity for a given interaction energy follow a Poisson distribution, is given for the variation in multiplicity of shower secondaries with energy. Experimental observations of Camerini et al. (Phil. Mag. (7) 42, 1261(1951)) are in good agreement with the equation.

4816
ALPHA PARTICLES IN PRIMARY COSMIC RADIATION. G. Segrè. Nuovo cimento (9) 9, 116-27(1952) Feb. (In Italian)

From an analysis of experimental data, the author suggests changing the published value of the absorption mean free path of primary α particles in air from 40 to ~80 g/cm^2 and the collision mean free path in photographic emulsion from 39 to ~120 g/cm^2. These values do not differ substantially from the ones assumed for protons. Corrected values given for the vertical intensity of the α particles at the top of the atmosphere at 30° and 51° geom. lat. are $I_0(30°) = 4 \pm 1.5 \times 10^{-3}$/cm^2-sec-sterad; $I_0(51°) = 18 \pm 6 \times 10^{-3}$/cm^2-sec-sterad. Mathematical calculations and curves, the use of which makes much easier handling of similar problems, particluarly those concerning heavy particles, are given.

4817
A POSSIBLE CHARGED V-PARTICLE OR KAPPA-MESON EVENT OBSERVED IN A PHOTOGRAPHIC EMULSION. L. Voyvodic. Phys. Rev. 86, 1046(1952) June 15.

One of the shower particles in a cosmic-ray disintegration (Phys. Rev. 86, 1045-6(1952)) shows a sudden change in direction through 20°, with no sign of a visible recoil. The combined grain-density and scattering results yield a mass of 1210 ± 180 m_e for the shower particle and >600 m_e for the secondary. A possible interpretation is that of charged V-particle decay into a τ meson and one or more neutral particles. An alternative interpretation is that of scattering of a κ meson, presumably nuclear scattering because of the large angle (20°) and short deBroglie wavelength (~2 × 10^{-14} cm).

4818
THE NATURE OF COSMIC-RAY BURSTS UNDERGROUND. C. N. Chou. Phys. Rev. 86, 1048-9(1952) June 15.

Integral size-frequency distributions of cosmic-ray bursts observed underground (Phys. Rev. 74, 1659(1948)) are reproduced and discussed. The curve representing bursts observed under 30 m of clay with the chamber unshielded and the curve representing bursts observed in the same position with 13 cm of Pb above the chamber are compared with the underground intensity vs. depth relation. The results show that either fewer μ mesons of energy higher than about 10^{11} ev and/or more μ mesons of energies in the range 10^{10} to 10^{11} ev exist under 60 m water equivalent than at ground level. The first process was formerly assumed to be responsible, but it is pointed out that the production of κ mesons at high energies may make the second process relatively important.

4819
COSMIC RAYS UNDERGROUND. D. C. Peaslee. Nuovo cimento (9) 9, 61-73(1952) Jan. (In English)

Cosmic rays underground are treated as entirely caused by the electromagnetic interactions of μ mesons. Simple approximations are given for the underground spectra of μ mesons, virtual photons, soft showers, and nucleons. Comparison with experimental data is satisfactory on the absolute rate of slow-neutron and nuclear-star production, and on the charge ratio of star primaries, if the charged primaries are at least half protons. Disagreement is found with the observed variation of star production with depth. Comparison with observation suggests that the cross section for nuclear excitation by γ rays decreases on the average more slowly than 1/E from its large measured value $\sigma_\nu/A \approx 1 \times 10^{-28}$ cm^2 per nucleon at E = 200 to 300 Mev. This mechanism therefore predominates over meson-proton knock-on in production of the underground nucleonic component. Measurement of slow neutron or star production over large differences in depth would yield more detailed information on the behavior of σ_ν/A at high energies. Measurement of the size-frequency distribution of soft showers at high energies would yield information about the production of neutral π mesons. (auth)

4820
A PHENOMENOLOGICAL THEORY OF COSMIC RADIATION IN THE ATMOSPHERE. P. Caldirola, R. Fieschi, and P. Gulmanelli. Nuovo cimento (9) 9, 5-35(1952) Jan. (In English)

Experimental results on the composition of cosmic radiation at the top of the atmosphere are used to develop a phenomenological theory of all processes which occur in the cosmic radiation while it traverses the atmosphere. The authors have computed the distribution of the fast nucleonic component (protonic and neutronic), the distribution of the mesonic component and its energy spectrum and positive excess at various altitudes, and the distribution of the electronic component. The latitude effects due to the earth's magnetic field are studied. The theoretical results obtained are discussed in the light of the most recent experimental data. (auth)

4821
COLLISION OF HEAVY PRIMARY COSMIC-RAY NUCLEUS. N. L. Allen, J. Y. Mei, E. Pickup, and L. Voyvodic. Phys. Rev. 86, 1045-6(1952) June 15.

In a 600-μ Ilford G5 emulsion exposed at ~85,000 ft an incoming nucleus with Z = 17 ± 3, as estimated by δ-ray counting, made a collision in which 45 singly charged particles with minimum or near-minimum ionization were produced with half-angle $\theta_{1/2} \approx 12.5°$. There was also a relativistic α particle at ~3.5° to the forward direction. A microprojection tracing of the event and the angular distribution are shown. The target nucleus was probably C, N, or O, and the energy of the primary particle was ~2 bev per nucleon.

4822
ANALYSIS OF THE NUCLEONIC COMPONENT BASED ON NEUTRON LATITUDE VARIATIONS. S. B. Treiman. Phys. Rev. 86, 917-23(1952) June 15.

A "specific yield" function $S_A(E,x)$ is defined which gives the production rate of disintegration neutrons at atmos-

pheric depth x arising from a unit flux of vertically incident cosmic-ray primaries of atomic weight A and energy-per-nucleon E. The functions are obtained by comparing the latitude variations for the primary-particle fluxes with the latitude variations for neutron production at various depths in the atmosphere. For atmospheric depths between at least 200 and 600 g/cm^2, it is found that the specific yields increase rapidly with energy up to about 4-bev/nucleon and then become insensitive to energy up to at least 12.7-bev/nucleon. It is also shown that this insensitivity probably extends up to considerably larger energies. The theoretical implications of these results are qualitatively discussed. (auth)

4823

THE SOLUTION OF THE FLUCTUATION PROBLEM IN ELECTRON-PHOTON SHOWER THEORY. H. Messel and R. B. Potts. Phys. Rev. 86, 847-51(1952) June 15.

The analytical solution is given for the fluctuation problem arising in electron-photon shower theory under approximation A. The diffusion equations for two fundamental distribution functions are derived, and by transforming them into matrix recurrence relations their solution is obtained directly. From one of these distribution functions follows the analytical solution for the (n,m)th moments. The method of solution is similar to that previously employed by Messel and Potts to solve the fluctuation problems in nucleon-shower theory. The G-equations used by Janossy and Scott play no role in the solution of the problem. (auth)

4824

A COMPARISON OF PENETRATING SHOWERS IN LIGHT AND HEAVY ELEMENTS. I. W. D. Walker, N. M. Duller, and J. D. Sorrels. Phys. Rev. 86, 865-70(1952) June 15.

A comparison of the multiplicity of penetrating particles has been made for penetrating showers originating in C and Pb, and for showers starting in Fe and paraffin. The comparison is made by observing the rates of different sized showers per mean free path of the generating material. Large differences are found in the comparison of Pb and C. The comparison of Fe and paraffin essentially gives a comparison of Fe and C as the showers originating in hydrogen were not recorded efficiently. The difference between showers starting in Fe and C is smaller than in the comparison of Pb and C. The ratio of neutral to charged primaries is determined to be 0.5 ± 0.15. The collision mean free path of charged primaries in paraffin is measured to be 56^{+12}_{-9} g/cm^2, and the mean free path of charged primaries in carbon is measured to be 76 ± 8 g/cm^2. A search was made for elastic scattering of penetrating shower primary particles in which only a small amount of energy is transferred to a target nucleon. Only one example of such scattering was observed in the traversal of 11,960 g/cm^2 of carbon. (auth)

4825

AN INTRINSIC ANGULAR ANALYSIS OF COSMIC RAY STARS. M. Della Corte and M. Giovannozzi. Nuovo cimento (9) 8, 741-8(1951) Oct. (In English)

An intrinsic angular-distribution analysis of three-pronged stars has been carried out. From the distribution of "resultants," "apertures," and "volumes," it appears reasonable to assume that a certain number of "recoils" are due to a fission-like process. For low-energy stars, there is some experimental evidence of the complete disintegration of light nuclei. (auth)

4826

MESONS ASSOCIATED WITH EXTENSIVE SHOWERS. S. Fubini. Nuovo cimento (9) 8, 843-50(1951) Nov. (In Italian)

The influence of the production of π mesons by photons on extensive air showers is considered. It is shown that an appreciable fraction of the mesons associated with showers is originated by photons. (auth)

4827

DETECTION OF NUCLEAR INTERACTIONS BY MEANS OF A CLOUD CHAMBER CONTAINING A CRYSTAL OF SODIUM IODIDE. G. Salvini. Nuovo cimento (9) 8, 798-805(1951) Oct. (In English)

A cloud chamber with a proportional crystal inside was operated in order to establish some properties of cosmic-ray nuclear events whose study is complicated or impossible in cloud chambers triggered with G-M counters, because of the selection introduced in detecting the events. The apparatus is described, and the results obtained in 60 days at sea level with respect to the mean free path of the shower particles in C (108 g/cm^2) and to the probability of production of the electromagnetic component in high-energy nucleon-nucleus collisions ($\sigma \approx \frac{1}{4}$ of the geometrical) are given. (auth)

4828

THE "N" COMPONENT OF COSMIC RAYS AT HIGH ENERGIES. P. Budini and G. Lanza. Nuovo cimento (9) 9, 381-90(1952) May. (In Italian)

A theory of the nucleonic cascade holding for energies larger than several bev is outlined; bremsstrahlung-like cross sections depending on the fractional energy (primary energy/secondary energy) are used, and recoil nucleons, fluctuations as well as deviations of the primary spectrum from a pure power law, are taken into account. It is found that the behavior of the nucleonic component in the atmosphere, in particular the variation with energy of the absorption thickness is well fitted with data experimentally derived; this circumstance justifies the hypothesis of the bremsstrahlung-like cross section in the energy range considered. For energies larger than some 10^9 bev cross sections are expected to deviate from the bremsstrahlung law because (a) as the energy increases new particles, like pions, are contributing to the nucleonic cascade, and (b) the multiplicity of the generated particles increases with energy. If these deviations are considered as rather slowly varying functions of the energy, it is possible to apply the usual mathematical procedures and it may be argued, by the aid of considerations rather largely independent of the particular form of the cross-sections, that the deviation (a) may be responsible for a partial increase of the absorption path, whereas the hypothesis (b), which comes into consideration for energies larger than those implied by the hypothesis (a), yields a diminution of the absorption path with increasing energy up to an asymptotic value practically equal to the geometrical path, for those processes in which a particle entirely loses its individuality in a single collision (catastrophic processes and sensibly larger in processes characterized by an inelasticity constant smaller than 1. (auth)

4829

MULTIPLE PRODUCTION OF MESONS IN PENETRATING SHOWERS. G. Bertolino, M. Cini, P. Colombino, and G. Wataghin. Nuovo cimento (9) 9, 407-12(1952) May. (In Italian)

Experiments concerning the multiple production of mesons in high-energy nucleon collisions were made during the year 1951 at the laboratory of Testa Grigia (altitude 3500 m). Fourfold, fivefold, and sixfold coincidences were registered simultaneously in two identical arrangements with paraffin on one of the apparatuses and graphite on the other, or without these materials. The graphite layer (85.3 kg) had a thickness of 12 g/cm^2, whereas the paraffin layer contained 12 g/cm^2 of C + 2 g/cm^2 of H. The coincidence set had a resolving time of 0.9 μsec for all orders of coincidences. The influence of the barometric pressure

on the frequency of penetrating showers (PS) was carefully studied, and a barometer effect of 21 ± 3% per cm of Hg was found for the PS selected. From comparison of the frequencies without materials, $(f_6/f_5) = 0.5 \pm 0.05$, with the frequencies $[(f_6)_P - (f_6)_G]/[(f_5)_P - (f_5)_G] = 0.8 \pm 0.3$ it follows that the average multiplicity of the observed PS is: $n \geq 10$ (per 0.4 m^2) (also for those created in the nucleon-proton collision). A discussion of various possible cases of simultaneous arrival of two or more nucleons on the producing layers and of a double collision in the paraffin layer (a first collision with a proton and a second collision with a carbon nucleous) shows that all these cases cannot contribute more than a few per cent to the observed effect. It is concluded that the observed excess of production of PS in paraffin compared with graphite must be interpreted as evidence of multiple production of mesons in the collision of incident nucleons with the protons in H. PS incident on an area of ~5 m^2 and containing more than 200 mesons were observed. (auth)

4830

MEASUREMENT OF THE POSITIVE EXCESS AT LOW ENERGY BY MEANS OF NUCLEAR EMULSION SANDWICHES IN A MAGNETIC FIELD. M. Merlin, B. Vitale, and Y. Goldschmidt-Clermont. Nuovo cimento (9) 9, 421-8(1952) May. (In Italian)

Ilford G5 nuclear plates 400-μ thick have been exposed as a sandwich with a space of 3.2 mm of air between them in a magnetic field of 30,000 gauss at sea level. The positive excess of μ mesons at the end of their range has been measured, and the value $\eta = 0 \pm 0.27$ obtained. The sensitivity of the method for the determination of either the mass of the sign of the charge is discussed in relation to the geometrical conditions and possible distortions of the emulsions. (auth)

4831

ENERGY SPECTRUM OF THE NUCLEONIC COMPONENT AT VARIOUS ALTITUDES. G. Cortini, A. Manfredini, and G. Segrè. Nuovo cimento (9) 9, 191-3(1952) Feb. (In Italian)

The number of stars produced in Ilford G5 emulsions was determined at an elevation of ~60 g/cm^2. The differential multiplicity spectrum was shown not to depend on the altitude. The mean free path of the nucleonic component in air was 108 ± 5 g/cm^2. The neutron/proton ratio increased very slowly with altitude.

4832

INCREASE OF THE PRIMARY SPECIFIC IONIZATION AT HIGH ENERGIES. P. Budini and G. Poiani. Nuovo cimento (9) 9, 199-201(1952) Feb. (In Italian)

The effect of dispersion of primary ions in a medium on energy loss by high-energy particles is calculated as percentage increase of the primary specific ionization over its minimum value in air, H_2, and He at both standard conditions and 100-atm. pressure, and in Ag, Br, and AgBr emulsion.

4833

SECOND, THIRD, AND FOURTH MAXIMA OBSERVED IN ROSSI TRANSITION CURVES. L. Allegretti and Abd El-Wahab Khalil. Nuovo cimento (9) 8, 1011-13(1951) Dec. (In Italian)

Coincidence-counter measurements under Pb at sea level at Alexandria, Egypt, disclosed second, third, and fourth maxima in the Rossi curve at 12.5 to 15, ~25, and ~37.5 cm of Pb, respectively. At these maxima, showers of small angle were about three times as frequent as large-angle showers.

4834

STATISTICAL QUESTIONS ON THE ANGULAR DISTRIBUTION OF PRONGS OF STARS PRODUCED BY COSMIC RADIATION. G. Lovera. Nuovo cimento (9) 9, 134-40(1952) Feb. (In Italian)

Some deviations from isotropy in the intrinsic angular distribution of prongs in cosmic-ray stars produced in nuclear plates can be accounted for by means of the statistics of correlated events. (auth)

4835

VERTICAL AND INCLINED POSITIVE EXCESS OF μ MESONS. E. Beretta, I. Filosofo, and B. Sommacal. Nuovo cimento (9) 9, 317-23(1952) Apr. (In Italian)

Differential measurements have been made at sea level on the positive excess of μ mesons in the energy interval between 0.7 and 1.5 Bev. The results are $\delta = 0.21 \pm 0.025$ in the vertical direction, $\delta_{east} = 0 \pm 0.023$ in the 45° east and $\delta_{west} = 0.41 \pm 0.025$ in the 45° west direction. The last values are explained by the influence of the earth's magnetic field on meson trajectories. By considering the same influence a value $\delta = 0.21 \pm 0.018$ of the excess at generation is deduced from the measurements in the inclined directions. (auth)

4836

PHOTON COMPONENT OF EXTENSIVE AIR SHOWERS. P. Bassi, A. M. Bianchi, and C. Manduchi. Nuovo cimento (9) 9, 358-64(1952) Apr. (In Italian)

The photons of extensive showers have been studied at sea level and at 2000 m with an anticoincidence method. The ratio between photons and electrons does not depend on the height and increases with the shower density. That the photonic component is present under heavy layers of Pb is made evident. (auth)

4837

PHOTONS IN EXTENSIVE ATMOSPHERIC SHOWERS. P. Bassi, A. M. Bianchi, and C. Manduchi. Nuovo cimento (9) 8, 735-7(1951) Sept. (In Italian)

At sea level, two fold coincidences between counter trays of 1200-cm^2 area, 4 m apart, were used to select extensive showers, while photons were detected in a transition layer below an anticoincidence shield, The transition effect became saturated in ~20 g/cm^2 Pb.

4838

INVESTIGATION OF A TIME EFFECT IN THE PENETRATING COMPONENT OF COSMIC RADIATION. P. Budini and G. Poiani. Nuovo cimento (9) 8, 732-4(1951) Sept. (In Italian)

Results of coincidence studies on the diurnal variation of penetrating (>1 bev) cosmic radiation are graphed.

4839

SOME OBSERVATIONS ON STAR-PRODUCING RADIATION AT HIGH ALTITUDES. M. M. Addario Indovina. Nuovo cimento (9) 8, 729-31(1951) Sept. (In Italian)

NTB3 nuclear plates were exposed for 6 hr under 0 and 21 g/cm^2 of graphite during balloon flights to an altitude equivalent to 16 g/cm^2, at 21° and 57° N geomagnetic latitude. The rates of production of the different star types were measured. Although there was no significant transition effect in the graphite at 31° N for any stars, at 57° N there was a significant increase under the absorber of stars without minimum ionization tracks, but not for stars with such tracks.

4840

METHOD FOR DISCRIMINATION OF TWO-PRONG STARS IN NUCLEAR EMULSIONS. M. Merlin and O. Pierucci. Nuovo cimento (9) 8, 528-33(1951) Aug. (In Italian)

A method is proposed which permits distinction between two-prong stars and apparently similar events. The method is based on the fact that, apart from the case of very low energies, all two-prong events with a scattering angle of at least 120° can be considered as stars. By assuming isotropic distribution for evaporation prongs, the total number of two-prong stars can be obtained by extrapolation. It has been verified that the other two-prong events, mainly due to single coulomb scattering, satisfy the Rutherford formula. (auth)

4841
CONSTITUTION OF EXTENSIVE SHOWERS OF COSMIC RAYS. C. Milone. Nuovo cimento (9) 8, 643-50(1951) Sept. (In Italian)

The lateral structure of extensive cosmic-ray air showers was studied at Catania, Italy (elevation 35 m) by means of G-M counters by selecting showers with average density of ≈25 particles/m^2 in the vicinity of the cores of the showers. The ratio R_p/R_s = density of the penetrating particles/density of the total component at a distance r from the core of the shower was found to increase slowly with r. It was excluded that this increase was due to the experimental disposition of the counters. (auth)

4842
HIGH ENERGY EVENT IN NUCLEAR EMULSIONS AT 4550 m. A. Gerosa and R. Levi Setti. Nuovo cimento (9) 8, 601(1951) Aug. (In English)

A microprojection of an event initiated by a 10^{13}-ev proton is shown. A collimated shower of relativistic particles is directly opposite the incident track, and three minimum-ionization particles are ejected in a wider cone. In the collimated beam are present seven minimum-ionization tracks grouped together in a narrow cone of 0.004-radian width, assuming the aspect of a single heavy track near the center of the star; eight other relativistic particles lie around the central core in a cone of about 0.1 radian width. This star may be considered one of the most energetic interactions observed at this relatively low altitude of exposure (4550 m), the only other examples of this type being found in plates exposed at about 30,000 m.

ELECTRICAL DISCHARGE

4843
Research Lab. of Electronics, Mass. Inst. of Tech. PROBE STUDIES OF ENERGY DISTRIBUTIONS AND RADIAL POTENTIAL VARIATIONS IN A LOW-PRESSURE MERCURY ARC, by R. M. Howe. Jan. 18, 1952. 28p. (NP-3966; Technical Report No. 221)

Probe measurements were made in the plasma of a low-pressure mercury arc. The electron-energy distributions showed depletions from a Maxwellian distribution in the high-energy range. Coupling effects between adjacent probes were investigated and were found to be quite small but in the proper direction to agree with the Langmuir-Tonks theory. Drift-current distortion of the random electron-energy distributions was measured with a bidirectional probe and compared with theory. A multisection probe extending from tube axis to tube wall allowed a determination of radial potential and density variations. Results over a pressure range from 3.4 to 3.5 microns showed good agreement with the ambipolar diffusion theory based on cumulative ionization. A direct calculation of ionization rate in the plasma was made from the ionization probability for a one-step ionizing process; comparison of this calculation with the observed ionization rate at 1.7 microns indicated that at that pressure the ionization is half direct, half cumulative. For higher arc pressures cumulative ionization evidently predominates. (auth)

ELECTRONS

4844
RADIATION LOSS BY ELECTRONS IN LARGE ORBITS. Dale R. Corson. Phys. Rev. 86, 1052-3(1952) June 15.

It is explained how the radiation loss by electrons moving in large orbits in a uniform magnetic field can be measured by observing how the orbit radius in a synchrotron changes with time when the r-f accelerating voltage is removed. The results for electron energies from 225 to 275 Mev are shown. The measurements give results about 30 ev per turn greater than the classical calculation, but this may represent a systematic error. It is concluded that there can be little doubt of the soundness of the classical calculation.

4845
ON THE STRESS TENSOR OF THE ELECTRON. Sidney Borowitz and Walter Kohn. Phys. Rev. 86, 985-95(1952) June 15.

A suggestion by Schwinger for dealing with problems of gage invariance has been adapted for treating the radiative corrections to the stress tensor of an electron. The divergencelessness of the stress tensor implies that a certain divergent integral be invariant with respect to translation. Application of this rule gives a zero self-stress and shows that the matrix elements of the symmetric tensor between states of unequal momenta are finite. The canonical tensor however remains infinite. The connection with the results of Rohrlich, and Villars, and Pais and Epstein, is discussed. (auth)

4846
AN ELECTRON MODEL. Jésus M. Tharrats-Vidal. J. phys. radium 13, 283-8(1952) May. (In French)

A point model of the electron with a topology conforming with microscopic theories that reject metrical models and with a finite energy is presented. A continuous distribution of electric density and a non-zero charge that can be reduced to a point are features. The classical radius, the two spins, and the existence of positrons and negatrons are obtained directly. A relation is demonstrated between this model and quantum theories.

GASES

4847
INELASTIC COLLISIONS BETWEEN IONS AND ATOMS. J. B. Hasted. Proc. Roy. Soc. (London) A212, 235-48(1952) Apr. 22.

Charge-exchange cross sections for H^+, D^+, O_2^+, H_2^+, O^+, CO^+ and N_2^+ in A; D^+, O^+ and N^+ in Kr; D^+, C^+ and Br^+ in Xe, and O^+ in H_2O have been measured between 25 and 4000 ev energy by a method previously described. The normal atomic collision cross sections rise to a maximum at a voltage which depends on the value of $\Delta E \sqrt{M}$ for the process, M being the atomic mass and ΔE the energy defect of the reaction. Collisions between negative ions and atoms have been studied with the same apparatus, the cross section of the detachment reaction $X^- + Y \rightarrow X + e + Y - \Delta E$ being obtained. For S^-, Br^-, I^-, C^-, P^-, Li^- in Ne, and H^- in He, Ne, A, Kr, Xe, this rises with increasing energy of the incident ion. For O^- in He, Ne, A, Kr, Xe, Cl^- in He, Ne, A, Kr, Xe, and F^- in Ne, Kr, Xe the cross section at low energies is unexpectedly large for the value of $\Delta E \sqrt{M}$. This may be interpreted as being due to the presence of excited states of these ions, of low electron affinities, in the beam. With O^-, a low-energy electron bombardment source gave smaller cross sections, i.e., a smaller proportion of excited ions. (auth)

4848
THE SECOND COEFFICIENT OF VISCOSITY OF LIQUIDS AND GASES. S. M. Karim and L. Rosenhead. Revs. Modern Phys. 24, 108-16(1952) Apr.

The classical theory of the dynamics of viscous fluids is based on the assumption that there is only one fundamental coefficient of viscosity, μ, the coefficient of shear viscosity. The other quantity, μ', the second coefficient of viscosity, is assumed to be equal to $-2\mu/3$ in order that $\kappa (= (2\mu + 3\mu')/3)$, the coefficient of bulk viscosity, should be zero. In making this assumption classical hydrodynamics parts company from classical elasticity, in which two fundamental quantities, the Lamé constants λ and μ, are introduced. The above

assumption seems to have some basis on theory only in the case of ideal monoatomic gases; it has, however, been carried over implicitly to both liquids and gases of all degrees of complexity. One might therefore expect some differences to exist between theoretical predictions and experimental results due to this oversimplification. The present review has been undertaken with a view to exploring the existence and the magnitude of any such differences. Up to the present, discrepancies have been noticed in the field of investigation which deals with the transmission of sound energy through liquid and gases. As far as liquids are concerned no work has been done on the absorption of energy associated with vibrations in the sonic range (20 to 20,000 vibrations per second). In the ultrasonic range experimental values of absorption differ from the theoretical ones by factors ranging from 3 to 1000. In gases, both in the sonic and supersonic ranges, the values differ by a factor whose magnitude lies in the range of 4 to 100. Most of the work which has been done in this field has been concerned with the passage through liquids of sound energy in the ultrasonic range of frequencies. Here it is clear that the value of μ'/μ deduced from experiment is in good agreement with the value of the ratio deduced from information on excess absorption of energy. The viscosity ratio is never negative; its value ranges from about 1 to 120 in the cases so far investigated. (auth)

INSTRUMENTS

4849
Argonne National Lab.
A MERCURY PISTON GAS PUMP, by Donald L. Buchanan. June 1952. 8p. (AECU-2106; UAC-583)

A double action "mercury piston" gas pump has been constructed for ventilating animal exposure chambers in isotope experiments. The pump can be used to collect successive and equal volumes of gas and to isolate these volumes for separate analysis. It will pump discrete portions of gas (0 to 1000 cc) at any rate below 2000 cc per minute. The rate of flow does not vary during a stroke, the strokes are essentially continuous, and their duration can be precisely adjusted.

4850
Notre Dame Univ.
A DEVICE FOR HIGH-INTENSITY, VACUUM-IRRADIATION OF SMALL SAMPLES AT CONTROLLED TEMPERATURES, by C. S. Bachofer. [nd] 6p. (AECU-2116)

A device for high-intensity x irradiation of small biological samples at controlled temperature and vacuum is described and illustrated.

4851
Los Alamos Scientific Lab.
A SINGLE-CRYSTAL MICRO-BEAM X-RAY GONIOMETER, by Joseph Singer, John A. Richards, and William C. Moxley. [nd] 8p. (AECU-2121; LADC-1207)

A goniometer head is described which was designed to attain maximum versatility with single-crystal areas of an x-ray-diffraction microcamera. The head has two lateral drives and a vertical adjustment above the arcs. The vertical adjustment assembly of the goniometer head is made of Invar, for use with a micro-furnace, and the remainder of the head is stainless steel. This design, in conjunction with the feature that the two arcs were made concentric at the same point on the axis of rotation, makes it possible to keep a selected specimen area centered during orientation adjustments. The precision of the centering is about 5 microns. Either complete rotation of the specimen or cam-controlled oscillations may be obtained. Schematic drawings of the goniometer assembly, the collimation assembly, and the microcamera and x-ray tube assembly are included.

4852
Mound Lab.
INSTRUMENTATION AND TECHNIQUES, QUARTERLY PROGRESS THROUGH JUNE 17, 1952, by J. W. Heyd. June 30, 1952. 6p. (MLM-713)

Progress is briefly reported on analytical chemistry, balances, colorimetry, quartz fibers, radiation absorption and measurement, special instrumentation, and spectroscopy.

4853
Allis-Chalmers Manufacturing Co.
DEVELOPMENT OF ELECTROMAGNETIC PUMPS SUITABLE FOR PUMPING LIQUID METALS; PROGRESS REPORT ON 100 KW UNIPOLAR GENERATOR, by Edward L. Young. July 1, 1952. 16p. (NP-3962; Interim Progress Report No. 10)

This report covers the development of a unipolar generator, supplying power at 1 volt and 100,000 amp, for use as a power supply for a d-c Faraday liquid-metal pump.

4854
A SIMPLE INTERVAL TIMER. J. García de la Noceda, R. Arce, and A. Cobas. Rev. Sci. Instruments 23, 305(1952) June.

A circuit for an interval timer that records tenths of seconds is sketched. An impulse counter reading up to 10^4 is used, making the maximum measurable time interval 999 sec. The accuracy of the timer is determined by the accuracy of the line frequency. The absolute error tends to be greater as the time interval is lengthened.

4855
A NEW COINCIDENCE METHOD. E. Gatti and E. Germagnoli. Nuovo cimento (9) 9, 189-90(1952) Feb. (In Italian)

In a method for high resolution times (10^{-7} sec), the pulses coming from one detector are delayed, then mixed with undelayed pulses from a second detector. The amplified pairs of pulses go directly to one of the branches of the coincidence circuit, then through a delay line, identical with the first, to the other branch. The method thus requires a single amplifier, and it is not necessary that the delay introduced by the amplifier be constant. The number of spurious coincidences, however, is doubled.

4856
A SPECTRAL TEMPORAL SELECTOR OF ELECTRONIC IMPULSES. A. Alberigi, F. Lepri, and G. Stoppini. Nuovo cimento (9) 9, 365-8(1952) Apr. (In Italian)

A special type of electronic pulse amplifier is described which selects the last pulse in a temporal succession of an unknown number of pulses distributed in an arbitrary way within a fixed time interval. (auth)

4857
COUPLING OF "SCALE OF TWO." R. Ascoli. Nuovo cimento (9) 8, 584-5(1951) Aug. (In Italian)

A method of coupling scale-of-two circuits is suggested which presents considerable advantages as to simplicity of calculation and reliability of operation compared with other resistance- and capacity-coupled circuits. (auth)

4858
PERMANENT MAGNETS FOR SPECTROGRAPHS AND NUCLEAR PHYSICAL RESEARCH. D. Hadfield, and D. L. Mawson. J. Applied Phys. 3, 199-202(1952) June.

Composite permanent magnets, embodying the latest anisotropic alloys, are being used increasingly in equipment for research in many branches of applied physics. Among the advantages are freedom from power supplies, and also constancy of field, when compared with the electromagnet. Flexibility is achieved in the electro-permanent magnet by either reinforcing the permanent magnet field or artificially aging to a reduced value of field strength. Particular applications are for cosmic-ray traps, nuclear magnetic reso-

nance apparatus, mass spectrometers, and β-ray spectrographs; the design of a magnet for the latter purpose being discussed in detail. (auth)

ISOTOPES

4859

Little, Arthur D., Inc.
INDUSTRIAL USES OF RADIOACTIVE MATERIALS; A SELECTED BIBLIOGRAPHY. Mar. 1949. 18p. (NP-3968)

This bibliography includes general background references, survey articles of industrial application and references dealing with specific fields. (177 references)

4860

VARIATIONS IN THE ABUNDANCE OF SULFUR-34. B. Lazard, G. Nief, and E. Roth. J. chim. phys. 49, 60-3(1952) Feb. (In French)

The isotopic ratio S^{34}/S^{32} was determined for 10 samples of native S and 3 samples of pyrites found in widely distributed locations. Extreme variations of 5% were observed.

ISOTOPE SEPARATION

4861

THE IDEAL PLANT FOR THE SEPARATION OF ISOTOPES. C. Marchetti and M. Silvestri. Nuovo cimento (9) 9, 97-104(1952) Feb. (In Italian)

Integral equations for an ideal cascade, i.e., one without mixing inefficiency, are derived. The energy consumption necessary to obtain a predetermined separation is expressed as a function of three constants characteristic of the process used. The results can be used to check the efficiency of real cascades against this standard of maximum efficiency physically attainable.

MASS SPECTROGRAPHY

4862

Argonne National Lab.
MASS SPECTROSCOPY, by Mark G. Inghram and Richard J. Hayden. Argonne National Lab. and Univ. of Chicago. Apr. 4, 1952. 144p. (AECU-2120; UAC-582)

The fundamental design and operational techniques pertinent to the efficient utilization of the ionic mass spectroscope are discussed in detail. No attempt is made to include the electronic circuits or the applications of the instruments. Both the theoretical and practical aspects of various types of analyzers, ion sources, ion detectors, and sample-introduction systems are discussed.

4863

ABERRATIONS OF MAGNETIC-SECTOR MASS SPECTROMETERS. L. Musumeci. Nuovo cimento (9) 9, 429-35(1952) May. (In Italian)

In a previous article (cf. NSA 4-5450) some cases of flat focusing of the first and second order were examined in the condition of maximum dispersion of the images. A more general method of calculation of the aberration is shown in the present work. The values of aberration and distribution density along the collector plate are calculated up to an initial 20° divergence of the tracks. This calculation is made for first- and second-order focusing. The advantage of the polar cylindrical expansions is set forth in comparison with other geometrical dispositives. (auth)

4864

STUDY BY MASS SPECTROMETRY OF BOND ENERGIES IN ALIPHATIC AMINES. Jacques Collin. Bull. soc. roy. sci. Liège 20, 707-10(1951) Dec. (In French)

The appearance potentials of methylamine, ethylamine, and n-butylamine were determined by the method of minimum potential for appearance of a detectable ion current in a Nier-type mass spectrometer. From the results, the upper energy limits of the C–C and C–N bonds in these amines were calculated.

4865

NOTE ON THE SUPERPOSITION METHOD IN MASS SPECTROMETRY. G. Careri. Nuovo cimento (9) 9, 128-33(1952) Feb. (In English)

A well-known condition to satisfy for ideal operation in mass spectrometry for abundance analyses is the linear superposition of all individual intensities on the collector cage. The molecular flow in a mass spectrometer is shown to be not the only condition to be fulfilled in order that the superposition method can be applied. The ionization, scattering, and neutralization processes must also be considered, and simple rules to get the right number of leaks, with the restraint of superposition, are worked out.

MEASURING INSTRUMENTS AND TECHNIQUES

4866

Argonne National Lab.
STUDIES WITH THE RANGER, by D. L. Hill. Apr. 14, 1947. Decl. May 7, 1948 and Dec. 5, 1951. 84p. (AECD-1945 (Rev.); Based on AECD-3281 and CP-3800)

A device, referred to as the Ranger, is described which permits the automatic electrical counting of heavy ionizing particles of selected species and range. Studies with the instrument are described, involving the Ra-Be neutron spectrum, U^{235} fission neutron spectrum, fission α particles and protons, and a search for the K^{40} (thermal n,p) reaction. The first two and last parts of this report were originally issued as AECD-1945 and the third and fourth parts as AECD-3281.

4867

North American Aviation, Inc.
STATISTICS OF FOIL COUNTING, by E. R. Cohen. Issued Sept. 11, 1950. 8p. (NAA-SR-100)

The statistical fluctuations to be expected in a foil-counting schedule are investigated. The schedule considered is the exposure of the foil to a constant neutron flux for a certain time interval, a wait time during which the foil is in a zero-flux field, and then a counting time during which decaying atoms are counted with a certain efficiency. In spite of this fairly complicated schedule it is shown that the number of counts recorded follows a simple Poisson distribution which is characterized by a single parameter, the mean number of counts to be expected. (auth)

4868

Welch, W. M., Manufacturing Co.
FINAL REPORT; RADIATION DOSIMETER READER, by Stanton H. Petry and Lawrence Kelsey. [nd] 37p. (NP-3860; U22261)

A portable field-operated instrument was developed for measuring radiation-film-badge densities. The unit is designed to read diffuse optical densities of photographic film and utilizes the magnephot system (U. S. Pat. 2,424,933). The components of the dosimeter comprise an oscillator, photoelectric probe, narrowband amplifier, indicating meter, 15-c.p. light source, regulated transformer, LV Se rectifier and filter circuit, d.c. voltage-regulator amplifier, and HV power supply. The various components designs are discussed as well as the instructions for operation and maintenance of the equipment. The accuracy limitations vary from ±0.02 density units at a density of 0.5 up to ±0.07 density units at a density of 3.5. The unit operates on a 115-v 60-cps source of the portable motor-generator type; variations in line voltage and frequency do not have an appreciable effect on accuracy. The instrument is temperature compensated to operate from −40 to +132°F. (NRS abst.)

4869

Department of Mines and Technical Surveys (Canada)
THE ROSENBLUM SPARK COUNTER, by G. G. Eichholz. Mar. 18, 1952. 15p. (NP-3887; TR-97/52)

The properties of wire spark counters are described. Such counters can be used for the detection of alpha par-

ticles. The counters operate at voltages from 3000 to 5000 volts and possess marked directional properties. Two new designs for multiple-wire counters, called the guitar and harp counters, are described and illustrated. The applications and limitations of the counters are considered in detail. (auth)

4870
New York Univ.
FOURTH QUARTERLY REPORT FOR MONTHS INCLUDING NOVEMBER, DECEMBER, JANUARY; RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. May 1952. 88p. (NP-3934; U22563)

The research reported includes fluorescence of organic molecules, investigations of different storage phosphors, conductivity investigation with fluorescent-powders impedance measurements with a-c fields, and a coincidence method for investigating very high-energy radiations using scintillations in liquid.

4871
Electrona Corp.
DEVELOPMENT OF RADIACMETER IM-79( )/PD; FIRST QUARTERLY PROGRESS REPORT COVERING PERIOD FEBRUARY 15 TO MAY 15, 1952, by Carl Bosch. [nd] 42p. (NP-3965)

Construction of preliminary models, design changes, fabrication procedures, and construction of special tools for construction of a portable, light-weight high-dosage radiacmeter (600 r) for field use are reported. Schematic drawings of the instrument, and photographs of preliminary models and special tools necessary to manufacture and adjust the indicating instrument are included.

4872
SCINTILLATION DETECTOR FOR ALPHA PARTICLES. A. Malvicini. Nuovo cimento (9) 9, 535-8(1952) June. (In Italian)

The author describes a scintillation counter for the detection of radioactive contaminations consisting of α-particle emitters. Its main features are high sensitivity, simple construction, and easy use. This counter is insensitive to x and γ rays; under conditions of good α-particle detection its background is less than 10 pulses per hour. (auth)

4873
FABRICATION AND PROPERTIES OF GEIGER COUNTERS FILLED WITH BROMINE VAPOR AND INTENDED FOR β AND γ PROSPECTING. C. Gimenez and J. Labeyrie. Nuovo cimento (9) 9, 169-83(1952) Feb. (In French)

Construction and properties of a β- and γ-ray counter filled with a Ne-A-Br_2 mixture are described. Counters of this type are stable and sturdy, function at low voltage (350 v), and are only slightly sensitive to variations in temperature between –70 and +125°C. They are thus well suited for portable prospecting equipment.

4874
PREPARATION OF PLASTIC SCINTILLATION PHOSPHORS. G. G. Eichholz and J. L. Horwood. Rev. Sci. Instruments 23, 305(1952) June.

Manufacture of plastic phosphors from polystyrene and an organic fluorescent material (terphenyl, fluorene, etc.) by pressure molding is described. The process requires only a simple press, and is considerably quicker and easier than casting. No polymerizing agent need be added. Cylindrical molds have been found preferable for ease of molding and clearing; other shapes can then be produced by machining the resulting plastic slugs.

4875
A LOW PRESSURE HELIUM CONTINUOUS CLOUD CHAMBER. Wolfgang J. Choyke and Carl E. Nielsen. Rev. Sci. Instruments 23, 307-9(1952) June.

Stability in the downward diffusion chamber described is achieved by cooling the absolute alcohol in the top to –130°C by propyl-alcohol-filled cooling coils inserted in liquid N_2. With He in the chamber the operation was observed over the pressure range 75 to 15 cm Hg. At atmospheric pressure a sensitive region of 3 cm is easily obtained. Tracks of β particles in the chamber are illustrated.

4876
A FAST NEUTRON SPECTROMETER. L. E. Beghian, R. A. Allen, J. M. Calvert, and H. Halban. Phys. Rev. 86, 1044-5 (1952) June 15.

A method is described for determining the energies of fast neutrons by measuring the pulse-height spectrum of only those recoil protons which have suffered a head-on collision. The pulse from a stilbene crystal, for which the scintillation energy is closely proportional to proton recoil energy, is delayed by 3.5×10^{-8} sec and fed into a coincidence circuit with a crystal of NaI(Tl) placed at 90° to the direction of the original neutron beam. Thus coincidences are selected which are due to neutrons traveling from the first to the second crystal with energies of <30 kev, so that, for a primary energy of several million volts, the recoil proton in the first crystal carries away >99% of the primary energy. Results of measurements on D-D neutrons are plotted.

4877
INSTRUMENTAL DETECTION OF RADIOACTIVE MATERIAL ON PAPER CHROMATOGRAMS. A. Russell Jones. Anal. Chem. 24, 1055(1952) June.

An improved instrument for the detection of radioactive material on paper chromatograms is described. A 5-mm slit was milled lengthwise into each of two ion chambers. The chambers were mounted horizontally with the slits opposed and about 0.5 mm apart. The paper strip was inserted between them and attached with scotch tape to the end of the chart paper. A weight attached to the other end of the strip drew it through between the ion chambers at the same rate as that of the chart paper, permitting correlation between the strip and chart.

4878
FREE-AIR AND THIMBLE IONIZATION CHAMBERS FOR GRENZ-RAY DOSIMETRY. W. J. Oosterkamp and J. Proper. Acta Radiol. 37, 33-43(1952) Jan.

A free-air ionization chamber is described for x radiation with a half-value layer (HVL) between 0.02 and 1 mm Al. A dose rate of 50,000 r/min can easily be measured. Rigid thimble ionization chambers can be made with relatively thick windows (0.2 mm and 0.45 mm, respectively) and wavelength independence between 0.02 and 1 mm Al and between 0.04 and 2.5 mm Al HVL, respectively. The wavelength independency is obtained by using for the wall a material that has an effective atomic number lower than that of air. The variations, as a function of the radiation quality, in the attenuation of the beam due to the chamber window and in the contribution to the ionization through secondary electrons released in the chamber wall are made to compensate by a suitable combination of window thickness, depth of the (flat) ionization chamber, and effective atomic number of the wall material. Dose-rate and absorption curves in Al, determined with these ionization chambers, are shown for a contact-therapy tube with mica-beryllium window (inherent filter equivalent to 40 μ Al) for 11, 16.5, 21.5, 31.0 and 49.5 kv d-c. (auth)

4879
A GRID IONISATION CHAMBER OF SPECIAL DESIGN FOR THE MEASUREMENT OF SOFT RADIATIONS. A. Somerwil. Acta. Radiol. 37, 44-8(1952) Jan.

An ionization chamber was constructed for accurate measurement of the dosage rate of soft radiations in a volume extrapolated to zero. To this end the mesh- and extrapolation-chamber principles were combined while a special grid device was introduced in order to keep the

measuring volume free from unwanted ions. The influence of such a device is shown in a graph. (auth)

4880
MEASUREMENT OF NEUTRON DENSITIES WITH CRYSTALS OF NaI(Tl). Bertel Grimeland. Phys. Rev. 86, 937-9(1952) June 15.

Crystals of NaI(Tl) were irradiated in a nuclear reactor and the induced activity in sodium and iodine registered with a photomultiplier tube. It was found that an absolute measurement of the activities can be made in this way. Since sodium is an almost pure "one over v" absorber the neutron density can be determined from its activity. Comparisons have also been made between the sodium and iodine cross sections for capture of thermal neutrons. With the sodium cross section equal to 0.47 barn, the cross section of iodine was found to be 5.00 barns. (auth)

4881
WIDE-RANGE LOGARITHMIC RADIATION METER. R. E. Bell and R. L. Graham. Rev. Sci. Instruments 23, 301-4 (1952) June.

A logarithmic radiation meter is described using as detector a photomultiplier and scintillation phosphor. A one-tube feedback circuit varies the voltage applied to the photomultiplier so as to hold its anode current constant for different incident radiation intensities. The voltage applied to the photomultiplier is then a nearly logarithmic measure of the radiation intensity over a range of 10^4. Circuit details and experimental results are given of a battery-operated portable model and an a-c operated model which incorporates means for correcting the slight compression toward one end of the scale found in the portable model. (auth)

4882
EXTENSION OF THE CARBON 14 AGE METHOD. J. Laurence Kulp and Lansing E. Tryon. Rev. Sci. Instruments 23, 296-300(1952) June.

The use of a 1-in. mercury shield around the screen wall counter inside the anticoincidence ring of cosmic-ray counters makes it possible to reduce the background from 5 to 2 cpm for an active counting volume 8 in. in length and 2¾ in. in diameter. This makes it possible to extend routine C^{14} age measurements to about 30,000 yr. (auth)

4883
THE HERSCHEL EFFECT AND SELECTIVE ERASING OF NUCLEAR EMULSIONS. Allen M. Goldstein and Charles H. Sherman. Rev. Sci. Instruments 23, 267-71(1952) June.

The Herschel effect has been used as a means of obtaining selective erasing of nuclear emulsions. Radiation which produces background fog is often unavoidably present in an experimental arrangement designed for the registration of the tracks of heavy ionizing particles. It has been possible to erase background darkening which would have completely obscured tracks without erasing any of the tracks, thus extending useful exposure periods. The possibility of selective erasing by use of the Herschel effect is presented in terms of the Gurney and Mott theory of latent-image formation. Background darkening on Eastman Kodak NTA emulsion was produced by visible light, x rays, γ of Co^{60}, and β of $Sr^{90}-Y^{90}$; the 5.3-Mev α-particles of Po^{210} were used to obtain the individual tracks. By use of an infrared exposure the permissible background exposures were increased by factors of 3 to 7, without destroying any of the tracks. Other information regarding the Herschel effect has also been obtained. (auth)

4884
VARIATIONS IN GRAIN DENSITY FOR RELATIVISTIC PARTICLES OBSERVED IN NUCLEAR EMULSION. Max Morand and Tsai-Chü. Compt. rend. 234, 2534-6(1952) June 23. (In French)

The grain densities of 3394 tracks of relativistic cosmic-ray particles in Ilford G5 emulsion have been analyzed. The distribution curve has a pronounced maximum, but is less unsymmetrical than the theoretical curve of energy-loss distribution.

4885
VELOCITY OF MIGRATION OF ELECTRONS IN AN ELECTRIC FIELD IN ARGON. L. Colli and U. Facchini. Nuovo cimento (9) 8, 891-2(1951) Nov. (In Italian)

By studying the time constant for build-up of α-particle pulses in an ionization chamber, the authors found that the migration velocity of electrons in A increased slowly and almost linearly with E/p, where E is the electric field in v/cm and p is pressure in mm Hg, being about 0.4 cm/μsec for $E/p \approx 1$. The results in A, A-1% N_2, and A-0.1% N_2 are graphed and compared with results of other investigators.

4886
COUNTERS USING CHERENKOV RADIATION. P. Bassi. Nuovo cimento (9) 8, 807-9(1951) Oct. (In Italian)

An apparatus for counting cosmic-ray particles by their Cherenkov radiation is described.

4887
A METHOD FOR ESTIMATING LOW LEVELS OF RADIOACTIVE CONTAMINANTS IN WATER. A. H. Emmons and R. A. Lauderdale. Nucleonics 10, No. 6, 22-3(1952) June.

A new column-type water monitor for measuring low concentrations of activity is described. A special G-M tube, surrounded by an ion-exchange resin bed, is connected to a counting-rate meter that feeds to a recorder. The recorder plots build-up of activity on the resin bed as a function of time or, at constant flow, as a function of volume through the bed. For use as a continuous monitor, the unit could consist of two-columns; while one is operating as a β-γ monitor, the other can be regenerated.

4888
PHYSICS OF CRYSTALLINE PHOSPHORS. F. Stockmann. Naturwissenschaften 39, 226-33, 246-54(1952) May, June. (In German)

A critical, detailed review of certain aspects of phosphor physics is presented. SrS and ZnS doubly activated with rare earths are considered as examples of phosphors with chemically identical activator and absorbing centers, photoelectric conductivity and photography mechanisms are discussed, a quantitative treatment of phosphorescence and fluorescence in crystals is given, and the relation between thermoluminescence and the energy spectrum of the absorbing centers is investigated. 63 references.

4889
CYLINDRICAL EMULSIONS. A. Bonetti and G. P. S. Occhialini. Nuovo cimento (9) 8, 725-7(1951) Sept. (In English)

The advantages of studying the tracks of ionizing particles in nuclear emulsion by containing the radioactive source in thin-walled glass capillary tubes surrounded by gel-type emulsion are discussed. Results with P^{32} β particles and ThC′ (Po^{212}) α particles are illustrated. Prevention of shrinkage and problems of microscopic observation are discussed.

4890
USE OF SILICONES IN PREPARATION OF SAMPLES FOR RADIOACTIVITY MEASUREMENT. W. J. Wingo, J. H. Gast, and F. L. Aldrich. Science 115, 714(1952) June 27.

The use of silicones in preparing samples of uniform area and position for radiometric analysis is discussed. Methods are described for mounting samples on flat metal planchettes and on microscopic cover glasses with the aid of silicones.

4891
REMARK ON THE SULFUR-CRYSTAL COUNTER. Mitsuo Sakai and François Lurçat. Compt. rend. 234, 2061-2(1952) May 19. (In French)

We have repeated the study of the S-crystal counter carried out by Georgesco (Compt. rend. 228, 383(1949); NSA

3-831). We have been able to show that the observed pulses due to the action of α rays did not arise from an effect in the crystal, but from the effect of ionization of the air between the electrodes holding the crystal. (Entire report)

4892

VELOCITY OF MIGRATIONS OF ELECTRONS IN ARGON-ALCOHOL MIXTURES. A. Alberigi Quaranta, L. Mezzetti, E. Pancini, and G. Stoppini. Nuovo cimento (9) 8, 618-42 (1951) Sept. (In Italian)

A new experimental method for determining the transit time of the electrons in a G-M counter is described. Use is made of the results obtained with various experimental arrangements for the study of the dependence of the drift velocity on the electric field strength. For values of E greater than 200 v/cm, in a mixture of 90 mm Hg of A and 10 mm Hg of C_2H_5OH, the drift velocity turns out to be practically independent of the applied field, with a value of $5.2 \pm 0.8 \times 10^6$ cm/sec. This conclusion is compared with the results obtained by other authors and is discussed qualitatively in terms of the different types of collisions which the electron undergoes with the molecules of the gaseous mixture. Some results are also given on the best operating conditions of G-M counters in experiments in which it is important to minimize the time lags due to the spread of the discharge along the central wire. (auth)

4893

A WILSON CHAMBER OF LARGE DIMENSIONS FOR COSMIC-RAY RESEARCH. A. Lovati, A. Mura, G. Tagliaferri, and L. Terra. Nuovo cimento (9) 8, 713-24(1951) Sept. (In Italian)

For research on cosmic radiation, a large Wilson cloud chamber has been built, suitable for containing several thick plates up to a total weight of several hundred kilograms. The instrument is capable of rapid assembly and disassembly for repair and change of plate layout. Together with its associated equipment it occupies only a limited floor area. These characteristics seem quite useful in a mountain laboratory. (auth)

4894

RECENT RESEARCH ON RADIO-LUMINESCENCE. G. F. J. Garlick, J. Applied Phys. 3, 169-172(1952) June.

During the last few years the development of sensitive photoelectron multiplier and of single crystals has made possible a quantitative study of luminescence in solids excited by electrons or by heavy particles. Previous empirical relations found between luminescence, electron potential and beam current are shown to be due to the complex structure of the powder-form screens used. Much simpler behavior is indicated when the luminescence emission due to excitation of single crystals by single particles is investigated. In many inorganic crystals the luminescence is found to be proportional to the energy absorbed. Deviations from this linearity, particularly in organic crystals, provide indications of the nature of energy-transport mechanisms in crystals. Studies of phosphors deposited as optically clear films on glass provide similar evidence and enable range-energy relations to be studied for the exciting electrons. Recent theoretical researches have provided ideas on the nature of nonradiative processes in particle-excited phosphors. These processes are of practical interest since they account for at least 80% of the energy adsorbed by phosphor screens. (auth)

MESONS

4895

Rochester Univ.

THE TOTAL CROSS SECTIONS OF POSITIVE PIONS IN HYDROGEN, by S. W. Barnes, D. L. Clark, J. P. Perry and C. E. Angell. June 24, 1952. 7p. (NYO-3215)

The total cross sections of 37-Mev (mean energy) positive pions in H have been measured by means of a scintillation counter telescope. Three crystals in coincidence defined the meson beam, and a fourth, in anticoincidence, recorded events in the attenuator which removed particles from the beam. The measured cross section, based on 9×10^5 pions, is (after correcting for muon contamination) 12.4 ± 3 mb. If the scattering at this energy is assumed to be isotropic in the center-of-mass system, the total cross section is 16.6 ± 4 mb; a $\cos^2 \Theta$ distribution gives a σ_t of 20.8 mb; a $\sin^2 \Theta$ distribution yields 14.9 mb.

4896

Rochester Univ.

ON THE ξ^0 MESON, by M. F. Kaplon and D. M. Ritson. June 24, 1952. 4p. (NYO-3216)

In order to obtain evidence relating to the new ξ particle proposed by Danysz, Lock, and Yekutieli (Nature 169, 364 (1952)), showers characterized by a median charged multiplicity of ~20 particles with a median energy of $\sim 5 \times 10^{12}$ ev were examined. From the relationship between the angular separation θ_s of pairs of shower particles (presumed π mesons) in the diffuse part of the shower, the polar angle Θ with respect to the shower axis of the line bisecting Θ_s, and the maximum possible angular separation between the two mesons, it was found that some of the shower-particle pairs can be explained by the scheme $\xi^0 \rightarrow \pi^+ + \pi^- + Q$ ($Q < 6$ Mev). However, the data do not require the introduction of this new particle to explain the angular correlations.

4897

Radiation Lab., Univ. of Calif.

ON THE REACTIONS $p + d \rightarrow \pi^+ + H^3$ AND $p + d \rightarrow \pi^0 + He^3$, by M. Ruderman. May 14, 1952. 9p. (UCRL-1819)

The production of π^0 and π^+ mesons from the bombardment of deuterons by protons is discussed. Momentum exchange in the reactions and wave function relationships between the produced tritons and incident deuterons is described. The differential cross section for the reaction $p + d \rightarrow \pi^+ + H^3$ is estimated generally and also for 345-Mev incident protons.

4898

ON THE ENERGY RANGE RELATION FOR FAST MUONS IN ROCK. M. Mandò and L. Ronchi, Jr. Nuovo cimento (9) 9, 517-29(1952) June. (In English)

A discussion is given of the best estimate of various types of energy loss; the energy-range relation for muons in rock and water is then evaluated. Apart from the uncertain amount of "nuclear" losses this relation should be quantitatively correct to about 1%. Finally, two different curves are given, corresponding to zero nuclear losses and 1.0×10^{-6} g^{-1} cm^2 fractional nuclear energy losses, respectively; within them, linear interpolation (for any amount of nuclear losses) is allowed. (auth)

4899

PHOTOPRODUCTION OF π^0 MESONS IN DEUTERONS. V. Mikhaĭlov and A. M. Baldin. Doklady Akad. Nauk S.S.S.R. 84, 47-9(1952) May 1. (In Russian)

The differential cross section for neutral-meson production by γ quanta on deuterons is derived by pseudoscalar meson theory, consideration being taken of the anomalous moments of the nucleons (cf. NSA 5-4831, 5-5823).

4900

COSMIC RAY EVIDENCE ON THE μ-MESON MAGNETIC MOMENT. D. C. Peaslee. Nuovo cimento (9) 9, 56-60 (1952) Jan. (In English)

A survey is made to determine what information is provided by the intensity-depth relation of cosmic rays underground on the possibly anomalous character of the μ-meson magnetic moment. Energy losses due to ionization, bremsstrahlung, and electron-pair creation by normal and anomalous Dirac particles are discussed. It is concluded that if the magnetic moment in terms of the Bohr magneton is $\mu_0(1 + \delta)$, the only limitation provided by present experience at depths of 3000 m water equivalent or less is $|\delta| > \sim 1$. (auth)

4901
PHENOMENOLOGICAL RELATIONSHIPS BETWEEN PHOTOMESON PRODUCTION AND MESON-NUCLEON SCATTERING. K. A. Brueckner and K. M. Watson. Phys. Rev. 86, 923-8(1952) June 15.

Photomeson production is studied on the basis of the hypothesis of charge independence combined with the suggestion from meson theory that the meson-nucleon state of angular momentum and isotopic angular momentum equal to ½ is one of strong, resonant interaction. Reasonable agreement with experiment is obtained, both as to the energy dependence of the cross sections and as to their ratios. Similar considerations lead to a possible explanation for the angular dependence of π^+ mesons produced in p-p collisions. (auth)

4902
CHARGED PHOTOMESONS FROM VARIOUS NUCLEI. Raphael M. Littauer and Darcy Walker. Phys. Rev. 86, 838-46(1952) June 15.

The yield of π^- and π^+ photomesons from a wide range of nuclei has been measured. The irradiating photon flux was 310-Mev bremsstrahlung and the mesons were selected magnetically at 135° with an energy of 65 ± 15 Mev. The experimental results include the following features: (1) the π^-/π^+ ratio from deuterium is close to unity; (2) the charged-meson cross sections for deuterium are close to that for hydrogen; (3) the total charged-meson cross section per nucleus varies as $A^{2/3}$; (4) the π^-/π^+ ratios show a remarkable correlation with the masses of the isobars adjacent in Z to the target nucleus; (5) the π^-/π^+ ratio from beryllium is energy sensitive. The implications of these results are discussed. (auth)

4903
NONLINEAR MESON THEORY OF NUCLEAR FORCES. III. QUANTIZATION OF THE NEUTRAL SCALAR CASE WITH NONLINEAR COUPLING. L. I. Schiff. Phys. Rev. 86, 856 (1952) June 15.

The problem of a number of infinitely massive point nucleons interacting according to the neutral scalar meson theory with a nonlinear coupling of the power-law type was considered classically in an earlier paper. It was found there that the interaction is the same as with the usual linear coupling. This system is now quantized, and it is shown that the same conclusion is valid in quantum theory. The case of exponential coupling lies outside the scope of the present investigation. (auth)

4904
K-CAPTURE OF μ MESONS. P. Budini. Nuovo cimento (9) 8, 901-8(1951) Dec. (In Italian)

The reaction of negatively charged mesons with atomic nuclei is examined on the hypothesis that the process involved is the transition

$$P + \mu^- \left\langle \begin{matrix} \pi^+ + N + \mu^- \\ \pi^- + P + \mu^0 \end{matrix} \right\rangle \mu^0 + N$$

with pseudoscalar mesons; only the pseudoscalar term of the interaction is considered. Contrary to what had been foreseen, the probability of the interaction is proportional, for the lightest nuclei, to the fourth power of the atomic number. The influence of the pseudoscalar theory on the problem of nuclear excitation is studied. (auth)

4905
ENERGY LOSS OF FAST MESONS BY PAIR PRODUCTION. M. Mandò and L. Ronchi, Jr. Nuovo cimento (9) 9, 105-15 (1952) Feb. (In Italian)

It has been pointed out by Hayakawa and Tomonaga (NSA 3-360, 4-2348, 4-2349) that the pair-creation process must give a contribution to the energy loss by fast particles comparable to that of the radiation process. For μ mesons (energy >100 bev) in rock (Z = 10, A = 20) they evaluate the average relative energy loss $(-1/E)(dE/dx)_p$, due to a pair creation, to be 1.6×10^{-6} g^{-1} cm^2, by extrapolating some approximate formulas for the cross section given by Bhabha. A similar calculation has been carried out by using, as a starting formula, the differential cross section $S(\epsilon, w, W_0)\, d\epsilon\, dw$ given by Racah, which holds exactly for $\epsilon \gg mc^2$, provided the effect of the screening can be neglected. A formula for the cross section $q(\epsilon, W_0)\, d\epsilon$ was then obtained; in the limit cases considered by Bhabha it allows a determination of his constants, but still differs somewhat from his formulas. For losses in single small steps (ϵ of the order of 10 mc^2) an approximate semi-empirical equation was used. By suitable methods of numerical integration the total loss was finally obtained. Since the starting formula neglects the screening, the result represents only an upper limit. It comes out that, while Hayakawa and Tomonaga's is a fairly good average value in the energy range 100 to 500 bev, the energy dependence of $(-1/E)(dE/dx)_p$ must be taken into account for an accurate evaluation.

4906
NEUTRAL MESON PRODUCTION IN ENERGETIC NUCLEAR ENCOUNTERS. A. Lovati, A. Mura, and G. Tagliaferri. Nuovo cimento (9) 9, 205-7(1952) Feb. (In English)

Cloud-chamber observations at 3500-m altitude on production of penetrating particles in nuclear explosions producing 0 to 5 electronic showers are evaluated. It was observed that as the multiplicity of penetrating particles per explosion increased, the mean number of electronic showers did not increase proportionally. Inherent difficulties in evaluating the ratio of neutral to charged π mesons in this type of experiment are discussed. The authors are of the opinion that for explosions produced in Pb by incident particles of 1 to 10 bev, the ratio should be 0.3 to 0.5.

4907
GENERATION OF π MESONS IN LEAD AND ALUMINUM EXPOSED TO COSMIC RAYS. N. Dallaporta, M. Merlin, O. Pierucci, and A. Rostagni. Nuovo cimento (9) 9, 202-4 (1952) Feb. (In Italian)

The numbers of π^+ and π^- mesons produced per cubic centimeter of Ilford G5 emulsion per day at 4550-m elevation under Al and Pb are tabulated. Generation spectra, range-energy relations, and mean free path are considered.

4908
CAPTURE OF μ MESONS BY CALCIUM. Jean Heidmann. Compt. rend. 234, 2062-3(1952) May 19. (In French)

The mean number of neutrons evaporated by the K^{40} nucleus excited to energy E by Ca^{40} μ-meson capture has been calculated for E = 5 to 25 Mev for various nuclear models. The values fall in the interval 0.1 to 0.7 neutron/capture, thus explaining the low experimental value (cf. NSA 6-4174) for Ca, assumed in these studies to be completely Ca^{40}.

4909
EXPERIMENTAL STUDY OF THE ENERGY SPECTRUM OF THE μ-MESON DISINTEGRATION ELECTRON. André Lagarrigue. Compt. rend. 234, 2060-1(1952) May 19. (In French)

The statistical distribution of 225 measurements of the μ-meson disintegration electrons in a Wilson cloud chamber with a magnetic field was found to be in good agreement with the expression derived by Michel (cf. NSA 3-729, 4-4394) for disintegration into one electron and two neutrinos. Parameters are given for this expression.

4910
ON THE DOUBLE SCATTERING OF MESONS BY NUCLEONS. M. Cini and L. A. Radicati. Nuovo cimento (9) 8, 542-51 (1951) Aug. (In English)

Differential and total cross sections are given for the double scattering of pseudoscalar mesons by nucleons. The

total cross section is compared with that for the single scattering. The cross section is also compared with that resulting from a more crude calculation using the method of Heitler and Nordheim (Physica 1, 1059(1934)). (auth)

4911

SHORT μ-MESON TRACKS FROM π-MESON DECAYS. W. F. Fry. Nuovo cimento (9) 8, 590-1(1951) Aug. (In English)

Some additional data on the same experiment described in Phys. Rev. 83, 1268(1951) (cf. NSA 5-7216) are presented. A possible explanation of the short μ-meson tracks is that the π-meson decays into a μ meson and three neutrinos.

METEOROLOGY

4912

Massachusetts Inst. of Tech.

A STUDY OF ATMOSPHERIC VORTICITY, by Richard J. Reed. Oct. 15, 1951. 32p. (NP-3941; Technical Report No. 10; U19871)

The study had 3 principal objectives: to determine the orders of magnitude of various terms in the vorticity equation (neglecting frictional forces), to test the reliability of the means of measuring these terms, and to compare actual vorticities with those for the geostrophic winds. The weather situation selected for the study combined high pressure rises with an abundance of upper-wind reports. The orders of magnitude in sec^{-2} were 10^{-9} to 10^{-8} for the divergence and vertical-shear effects and 10^{-10} to 10^{-9} for the latitudinal-displacement and solenoid effects. The vertical-shear effect may be neglected for the small vertical velocities near the ground. The magnitude of the terms can be reliably measured if sufficient wind reports are available. The correspondence between actual and geostrophic vorticities was close for well-defined pressure patterns. (cf. TIP U17692)

MOLECULAR PROPERTIES

4913

Mallinckrodt Chemical Lab., Harvard Univ.

APPROXIMATE TREATMENT OF THE EFFECT OF CENTRIFUGAL DISTORTION ON THE ROTATIONAL ENERGY LEVELS OF ASYMMETRIC ROTOR MOLECULES, by Daniel Kivelson and E. Bright Wilson, Jr. [nd] 15p. (NP-3954; U22488)

An approximate solution for the analysis of the rotational spectra of asymmetric rotor molecules is formulated which involves a general quantum-mechanical approach based on a first-order perturbation theory. The energy of the non-rigid asymmetric rotor is given by

$$W = W_0 + A_1W_0^2 + A_2W_0J(J+1) + A_3J^2(J+1)^2 + A_4J(J+1)\langle P_z^2\rangle + A_5\langle P_z^4\rangle + A_6W_0\langle P_z^2\rangle$$

where the A's are constants independent of the rotational quantum numbers (J, K_{-1}, and K_{+1}), W_0 is the rigid-rotor energy, and P_z is the operator for the component of angular momentum along the axis of quantization. Formulas are developed for $\langle P_z^2\rangle$ and $\langle P_z^4\rangle$ based on continued fractions as well as expansions useful for nearly symmetric cases. As a special case, corrections are derived for transitions between the components of asymmetry doublets. (NRS abst.)

4914

THE DIELECTRIC PROPERTIES OF COMPRESSED FLUOROMETHANE. H. G. David, S. D. Hamann, and J. F. Pearse. J. Chem. Phys. 20, 969-72(1952) June.

The dielectric constant, dielectric loss, and density of compressed fluoromethane have been measured at 50 and 75°C in the pressure range 20 to 160 atmospheres. The ratio $(\epsilon-1)/d(\epsilon+2)$ shows a large and regular decrease as the density increases. The theories of Debye, Onsager, and Kirkwood have been applied to the results. Evidence of the restriction of molecular rotation at high densities is adduced. (auth)

NEUTRONS

4915

Oak Ridge National Lab.

A DIFFUSION SOLUTION FOR THE CYLINDRICAL DUCTING PROBLEM OF INFINITE GEOMETRY, by David W. Whitcombe. Issued Apr. 19, 1950. Decl. June 30, 1952. 14p. (AECD-3413; ORNL-668; NEPA-1363)

The flux solution for an infinite cylindrical duct with a plane source of neutrons is solved for all points outside the hole by two methods. The first solution is an iteration solution; the second uses the steepest descent approximation. Both methods solve the same diffusion equation and boundary conditions. The first solution is included because there may be some cases where it will greatly reduce the computations. The second solution, in general, is to be preferred to the first. (auth)

4916

EVALUATION OF THE RATE OF NEUTRON ABSORPTION DURING MODERATION FOR A FLAT SAMPLE. Bernard Jacrot, Francis Netter, and Francis Tyrode. Compt. rend. 234, 2357-9(1952) June 9. (In French)

For a flat absorbing pile-oscillation sample of non-negligible thickness placed in an isotropic flux of neutrons in the process of being moderated, the number of neutrons captured per unit of time is evaluated for different laws of capture-cross-section variation as functions of neutron energy.

4917

DETERMINATION BY THE METHOD OF PILE OSCILLATION OF VARIOUS EFFECTS CAUSED BY ABSORPTION OF NEUTRONS DURING MODERATION. Francis Netter and Francis Tyrode. Compt. rend. 234, 2448-50(1952) June 16. (In French)

The modulation pulse produced by oscillation in the axial canal of the Châtillon pile of a Cd-sheathed absorbing sample permits evaluation of effects caused by neutron capture in the course of moderation. The standardization curve obtained with increasing thicknesses of B has been used to study neutron absorption by Hf, Sm, Hg, and U.

NUCLEAR PHYSICS

4918

Carnegie Inst. of Tech.

THE THREE-PHOTON ANNIHILATION OF POSITRONS AND ELECTRONS (thesis), by Robert T. Siegel. May 26, 1952. 52p. (NYO-3302)

The three-photon annihilation of positrons and electrons has been investigated experimentally by means of a triple-coincidence technique. Three NaI(Tl) scintillation counters in coincidence were used to study the occurrence of the triplet annihilation process when positrons annihilate against the electrons within solids, liquids, and liquefied gases. The annihilation rates in aluminum, liquid nitrogen, and liquid Freon-12 (CCl_2F_2) were compared with the theoretical predictions made under the assumption that free positron-electron pairs produced all annihilation events; experiment and theory agreed within the experimental error. The formation of stable ortho-positronium in Freon-12, SF_6, N_2, H_2, and He was verified and its comparative stability in these gases measured. The spectra of the annihilation rays from ortho-positronium were measured to demonstrate that energy and momentum are conserved in the three-photon annihilation process. (auth)

4919

Radiation Lab., Univ. of Calif.

SUMMARY OF WEEKLY RESEARCH PROGRESS MEETINGS OF FEBRUARY 7 AND FEBRUARY 14, 1952, by S. Shewchuck. May 26, 1952. 5p. (UCRL-1832)

Brief summaries of the following are presented: a talk by M. Ruderman on the classical theory of meson-nucleon scattering; a general nontechnical description of the UCRL differential analyzer, by J. Killeen; a report by C. I. Browne on the x radiation and soft γ radiation in Am^{241} and U^{237} decay (UCRL-1516; NSA 6-413); and a report by L. Wouters and R. F. Post on the scintillation-counter symposium which was held in Jan. in Washington, D. C.

4920

ON A QUESTION OF NUCLEAR SPECTROSCOPY. A. Gamba and M. Verde. Nuovo cimento (9) 9, 544-6(1952) June. (In English)

General expressions are derived for the multiplicities N_j of the angular momenta J associated with a given term of n equivalent nucleons for cases of n = 3 or 4 and arbitrary j. These equations are of interest because of the frequent need to deal with nuclei having a few equivalent nucleons of high angular momenta outside a closed shell.

4921

AN ASYMMETRIC NUCLEAR MODEL. S. Gallone and C. Salvetti. Nuovo cimento (9) 8, 970-6(1951) Dec. (In Italian)

Additional data on the discussion published by the authors in Phys. Rev. 84, 1064-5(1951) (NSA 6-1934) are presented.

4922

INTRODUCTION TO THE COMPARATIVE STUDY OF THE MAYER NUCLEAR MODEL AND β DISINTEGRATIONS OF NUCLEI. M. Trocheris. J. phys. radium 13, 299-307 (1952) May. (In French)

The general ideas and conventions necessary to undertake a systematic comparison of the predictions of Mayer's nuclear model for odd-A nuclei with the experimental facts of β radioactivity are reviewed. Mayer's model is presented as a particular case of an independent-particle model. A method is given for determining spin and parity changes in β transitions.

4923

ON THE UNIVERSAL FERMI-TYPE INTERACTION. I. E. R. Caianiello. Nuovo cimento (9) 8, 534-41(1951) Aug. (In English)

The question of the possibility of a universal Fermi-type interaction is reexamined. It is found that the answer may be positive, provided the possibility of two-neutrino annihilations of particle-antiparticle pairs is accepted; the cross sections for these last processes turn out however to be exceedingly small. These considerations are exemplified with a particular hamiltonian for the purpose of estimating at least qualitatively the prediction of such a theory: no claim is made as to the correctness of this choice. (auth)

NUCLEAR PROPERTIES

4924

Purdue Univ.

THE ANGULAR CORRELATION OF THE GAMMA RAYS EMITTED FROM THE EXCITED STATES OF Cd^{114} (abstract), by Rolf M. Steffen and W. Zobel. [nd] 1p. (AECU-2115)

The angular correlation of the 548- and 715-kev gamma rays of In^{114} has been measured using sources of $InCl_3$, $In_2(SO_4)_3$, and In-metal sources. In spite of the short lifetime of the intermediate state ($<2 \times 10^{-9}$ sec) an appreciable effect of the chemical state of the In^{114} sources on the angular correlation has been observed, the metal sources giving the supposedly unperturbed angular correlation: $f(\theta) = 1 + 0.09 \cos^2\theta + 0.07 \cos^4\theta$ (± 0.01). This correlation function is in good agreement with that reported before Rolf M. Steffen, (Phys. Rev. 83, 166(1951)) and Johns, Cox and McMullen, (Bull. of the APS, Vol. 27, No. 1 (1952)), however, the more accurate data make a revision of the former interpretation necessary. The observed angular correlation can be described in terms of a 4-2-0 cascade in which the 4-2 transition is a mixture of octapole and quadrupole radiation, or in terms of a 2-2-0 cascade in which the 2-2 transition is a mixture ($\delta = 0$) of quadrupole (4.4%) and dipole radiation (95.6%). In both cases the 2-0 transition to the ground state is by quadrupole radiation. The investigation of the 72-sec In^{114} ground state, produced directly by deuteron bombardment of In and Cd, showed conclusively that the gamma cascade follows the K-capture decay of the 72-sec In^{114} ground state indicating the spin 2 for the 1.26-Mev level of Cd^{114}. (Entire report. Abstract of paper for Denver meeting of Am. Phys. Soc., June 30, 1952.) (cf. AECU-1431; NSA 5-4902)

4925

Atomic Energy Research Establishment, Harwell, Berks (England)

STUDIES IN jj-COUPLING. II. FRACTIONAL PARENTAGE COEFFICIENTS AND THE CENTRAL FORCE ENERGY MATRIX FOR EQUIVALENT PARTICLES, by B. H. Flowers and A. R. Edmonds. Feb. 1952. 28p. (AERE-T/R-875)

Jahn's method of fractional parentage coefficients is adapted to obtain fully antisymmetric wave-functions for the configurations j^n of neutrons and protons, where $j = 3/2, 5/2, 7/2$, and n = 3 and 4. Invariant theory is used to obtain linear combinations of Slater integrals which have special transformation properties with respect to the unitary and symplectic groups. In this way it is shown how the ordering of levels in jj-coupling with short-range interactions is determined by the eigenvalues of Casimir's operator. (auth)

4926

Radiation Lab., Univ. of Calif.

SUMMARY OF WEEKLY RESEARCH PROGRESS MEETING OF MAY 22, 1952, by Sergey Shewchuck. June 2, 1952. 6p. (UCRL-1840)

An Excitation Function for the Reaction $p + p \rightarrow \pi^+ + d$, by A. Schulz. Measurements have been made of the relative cross sections for production of π^+ mesons at $0 \pm 5°$ to the proton-beam direction. At each proton energy the π^+ energy spectrum was scanned in the region of the characteristic peak and the relative $d\sigma/d\Omega$ was obtained by integrating over meson energy. The data obtained thus far agree with an $E^{3/2}$ curve, where E is the meson kinetic energy in the center-of-mass system. No data are given.

First Excited States of Even-Even Nuclei, by J. Rasmussen. A graph in which the energies of first-excited states of even-even nuclei are plotted against mass number is presented and discussed in terms of the liquid-drop model. If the liquid-drop interpretation of the low-lying levels in even-even nuclei is valid and if the principal factor diminishing the rotational symmetry is the zero point vibration, then there follow consequences affecting the theories of fission and alpha decay. These consequences are briefly considered.

4927

BINDING ENERGIES OF He^3 AND He^4. G. Morpurgo. Nuovo cimento (9) 9, 461-76(1952) June. (In Italian)

A method much more effective than former ones has been used to calculate the binding energies of H^3 and He^4. The idea on which the method is based is to look for the minimum of the mean value of the hamiltonian, not among a class of functions containing some parameters, but among the whole class of the functions of an argument (which is assumed to be the sum of the squares of the distances between the nucleons). With a gaussian potential and central forces (with the usual choice of parameters of Margenau (Phys. Rev. 52, 790, 1027 (1937); 54, 422(1938)) one obtains in the first approximation -7.24 Mev for H^3 and -26.77 Mev for He^4. These values have to be compared with -7.21 Mev and -26.76 Mev obtained by Margenau making use of systems of 13 and 11 variational

functions, respectively. A refinement for H^3 lowers its energy to −7.79 Mev. Other advantages of the method (among which is mentioned the right asymptotic form of the wave functions obtained) are listed. (auth)

4928

THE THERMAL NEUTRON DIFFUSION LENGTH IN A HETEROGENEOUS PILE. Gilbert N. Plass. J. Applied Phys. 23, 621-24(1952) June.

The diffusion equation for thermal neutrons in a pile with finite sides and having a three-dimensional lattice structure of fissionable material and moderator is solved to the first three orders by an expansion in spherical harmonica. This solution is used to calculate the difference in thermal utilizations of a pile of infinite extent and one with finite sides. From this difference is calculated an accurate expression for the diffusion length in a pile having a lattice structure. This expression is compared with the usual simplified equation for the diffusion length. The leakage of neutrons from a pile is also obtained from this calculation. (auth)

4929

HYPERFINE STRUCTURE ANOMALIES IN THE $^2P_{\frac{1}{2}}$ STATE OF Tl^{205} AND Tl^{203}. Alan Berman. Phys. Rev. 86, 1005-8 (1952) June 15.

The atomic-beam magnetic-resonance method has been used to make a precision measurement of the hyperfine-structure separation of the ground state of Tl^{205} and Tl^{203}. The experimentally determined ratio $\Delta\nu^{205}/\Delta\nu^{203} = 1.00974 \pm 0.00003$ is to be compared with the ratio of the magnetic moments, determined by nuclear-induction techniques, of $g_I^{205}/g_I^{203} = 1.00986 \pm 0.00005$. It is shown that the difference between the two ratios can be accounted for by consideration of effects predicted by Bohr and Weisskopf and by Crawford and Schawlow. In particular, the agreement between theory and experiment can be construed as evidence of the reality of the effects postulated by Crawford and Schawlow, which have not been heretofore directly observed. (auth)

4930

TRANSFORMATION AMPLITUDES FOR VECTOR ADDITION OF ANGULAR MOMENTUM; (j3mm′|j3JM). D. L. Falkoff, G. S. Colladay, and R. E. Sells. Can. J. Phys. 30, 253-6(1952) May

Tables of the transformation amplitudes for quantum-mechanical vector addition of angular momenta $\vec{j} + \vec{3} = \vec{J}$ are given.

4931

NUCLEAR ELECTRIC QUADRUPOLE INTERACTION IN SINGLE CRYSTALS. G. M. Volkoff, H. E. Petch, and D. W. L. Smellie. Can. J. Phys. 30, 270-89(1952) June.

Pound's theory of the dependence of electric quadrupole splitting of nuclear magnetic resonance absorption lines in a single crystal on the orientation of the crystal in an external magnetic field is extended to cover the case of a crystal with nonaxially symmetric electric field gradient at the site of the nuclei being investigated. It is shown that an experimental study of the angular dependence of this splitting for three independent rotations of the crystal about any three mutually perpendicular axes will yield complete information about the orientation of the principal axes and the degree of axial asymmetry of the electric field gradient tensor at the site of the nuclei, and also will give the absolute value of the quadrupole coupling constant for those nuclei. The authors' experiments on the splitting of the Li^7 absorption lines in a single crystal of $LiAl(SiO_3)_2$ (spodumene) are described and are used to illustrate the theory. The absolute value of the quadrupole coupling constant for the Li^7 nuclei in spodumene is found to be $|eQ\varphi_{zz}/h| = 75.7 \pm 0.5$ kc per sec. The axial asymmetry parameter of the field gradient tensor at the site of the Li nuclei is found to be $\eta = (\varphi_{xx} - \varphi_{yy})/\varphi_{zz} = 0.79 \pm 0.01$. One of the principal axes of this tensor (the γ axis corresponding to the eigenvalue of intermediate magnitude) is experimentally found to coincide with the b crystallographic axis of monoclinic spodumene as required by the known symmetry of the crystal. The other two principal axes are in the ac plane, the z axis (corresponding to the eigenvalue φ_{zz} of greatest magnitude) lying between the a and c axes at an angle of $48 \pm 2°$ with the c axis. (auth)

4932

THE MEASUREMENT OF PHOTONUCLEAR CROSS SECTIONS IN ISOTOPES LEADING TO SHORT-LIVED DECAY PRODUCTS. R. N. H. Haslam, R. G. Summers-Gill, and E. H. Crosby. Can. J. Phys. 30, 257-69(1952) May.

A dropping apparatus, including a new means of dosage-rate monitoring, has been designed to allow the observation of short-lived activities produced by betatron irradiation of various parent materials. The photonuclear cross section for the reaction $S^{32}(\gamma,n)S^{31}$ has been measured by this means. The cross section has a peak value of 24.6 millibarns at 20.1 ± 0.5 Mev, a half width of 4.5 Mev, and an integrated cross section of 0.12 Mev-barns. The reaction threshold was found to be 15.0 ± 0.1 Mev. The experiment has also yielded a new half life for S^{31} of 2.66 ± 0.03 sec. (auth)

4933

ANGULAR MOMENTUM DISTRIBUTIONS IN THE THOMAS-FERMI MODEL. J. H. D. Jensen and J. M. Luttinger. Phys. Rev. 86, 907-10(1952) June 15.

The Hartree and Thomas-Fermi models of the atom and nucleus are compared in their predictions for the angular-momentum distributions. It is found that the most natural quantity to compare is not the "first appearance" of a given orbital angular momentum, but the mean-squared angular momentum. (auth)

4934

NUCLEAR ENERGY LEVELS OF Al^{27}. E. M. Reilley, A. J. Allen, J. S. Arthur, R. S. Bender, and H. J. Hausman. Phys. Rev. 86, 857-9(1952) June 15.

Twenty energy levels in Al^{27} have been found by the magnetic analysis of inelastically scattered protons at 90° from thin targets of aluminum. An analyzed beam of 8.0-Mev protons was utilized for the bombardment. Tentative values for the levels found are 0.844, 1.016, 2.259, 2.782, 3.046, 3.736, 4.018, 4.115, 4.473, 4.575, 4.647, 4.875, 4.996, 5.107, 5.220, 5.341, 5.501, 5.565, 5.620, 5.736 Mev. A broad alpha-particle group from the $Al^{27}(p,\alpha)Mg^{24}$ reaction corresponding to an excited state of Mg^{24} was also observed and is believed to be complex. (auth)

4935

A STUDY OF THE 8.20-MEV LEVEL OF C^{13}. R. Ricamo. Nuovo cimento (9) 8, 893-5(1951) Nov. (In Italian)

Variation of the total neutron scattering cross section of C^{12} showed that the 8.20-Mev level of C^{13} has ½ spin. Angular distribution of the neutrons scattered at angles near $\pi/2$ showed that $l = 2$.

4936

TABLES OF NUCLEAR SHELL STRUCTURE. P. F. A. Klinkenberg. Revs. Modern Phys. 24, 63-73(1952) Apr.

The jj-coupling model of nuclear structure is applied to the ground states of the odd-mass nuclei and the odd-odd nuclei. The tables show number of neutrons and protons, atomic mass number, nuclear spin, magnetic dipole moment, electric quadrupole moment, occupation of proton and neutron shells, and ground state of the nucleus according to the shell model.

4937

AMPLITUDE MEASUREMENTS OF NUCLEAR SIGNALS. G. Chiarotti and L. Giulotto. Nuovo cimento (9) 8, 595-7 (1951) Aug. (In Italian)

A nuclear inductor similar to Bloch's (Phys. Rev. 70, 474(1946)) is described briefly. The nuclear relaxation

time of an aqueous ferric nitrate solution has been measured as an example of its accuracy.

NUCLEAR REACTORS

4938

Argonne National Lab.

THE ARGONNE HEAVY WATER REACTOR (CP-3 PRIME), by [W. H. Zinn]. Aug. 10, 1951. Decl. with deletions July 9, 1952. 40p. (AECD-3415; ANL-WHZ-311)

The 35 drawings in this report describe the heavy-water-moderated reactor at ANL.

4939

TRANSIENT BEHAVIOR OF NUCLEAR REACTORS WITH REFLECTORS. S. Gallone and L. Orsoni. Nuovo cimento (9) 9, 269-73(1952) Mar. (In Italian)

The influence of the reflector on the transient behavior of a nuclear reactor is considered, taking into account the prompt neutrons only. The critical size and the time constants are numerically evaluated for the case of a "flat" reactor. (auth)

4940

TIME-DEPENDENT NEUTRON SOURCES IN MULTIPLYING MEDIA. I. S. Gallone, L. Orsoni, and C. Salvetti. Nuovo cimento (9) 8, 960-9(1951) Dec. (In Italian)

Subcritical multiplying media containing nonperiodical time-dependent neutron sources are studied in the case of modulated and moving sources. Some simple cases, such as the instantaneous injection with a point source, the switching of a source of constant intensity, and the moving source are considered. A short discussion on the correction for non-vanishing mean free path of liberated neutrons and finite slowing down times follows. The transient behavior depends on the characteristic parameters of the multiplying medium, so that such methods may be of some use for studying subcritical pile elements. (auth)

NUCLEAR TRANSFORMATION

4941

Argonne National Lab.

THE REACTION $Li^6(\gamma,d)He^4$ AT 2.76 MEV, by Howard B. Glenn. June 23, 1952. 3p. (AECU-2104; UAC-590)

A search has been made for the $Li^6(\gamma,d)He^4$ reaction using 2.76-Mev γ rays from Na^{24}. Ilford C-2 nuclear emulsions loaded with enriched Li^6 were used. Using fused irradiated NaF, the Li^6 plates were exposed to approximately 10 r using ⅛ in. of Al to filter out the β rays from Na^{24}. Using the accepted mass values for Li^6, He^4, and H^2, the reaction threshold is found to be 1.58 Mev and there is 1.18 Mev available for the reaction products. From the kinetics of the problem, neglecting γ-ray momentum, the α particle receives ⅓ and the deuteron receives ⅔ of this energy. These correspond to ranges of 2 and 8 μ, respectively, in the emulsions used.

4942

Los Alamos Scientific Lab.

COULOMB FUNCTIONS FOR HEAVY NUCLEAR PARTICLES, by W. D. Barfield and A. A. Broyles. [nd] 2p. (AECU-2119; LADC-1206)

The results of calculations by contour integrals of coulomb functions for $\rho = 2\eta$ are tabulated. Since the coulomb functions and their first derivatives are given, an expansion around the point $\rho = 2\eta$ can be made. A table lists the number of terms in this expansion required to give a value of G_0 to within 1% of the correct value at $2\eta - \rho = 5$. It also gives the error in the steepest descent approximation at this point. A combination of the steepest descent approximation and the expansion around $\rho = 2\eta$ gives G_0 to better than 10% in the region of ρ for η's greater than 20. (cf. NSA 5-6437)

4943

Atomic Energy Research Establishment, Harwell, Berks (England)

IDENTIFICATION OF $(\gamma,p\alpha)$ REACTIONS IN NUCLEAR EMULSIONS, by M. J. Brinkworth, F. K. Goward, and J. J. Wilkins. Apr. 4, 1952. 7p. (AERE-G/M-130)

The extent to which the reactions $C^{12}(\gamma,p\alpha)Li^7$, $N^{14}(\gamma,p\alpha)Be^9$ and $O^{16}(\gamma,p\alpha)B^{11}$ may account for certain three-pronged stars observed in nuclear emulsions is discussed. It is suggested that the first reaction accounts for at least 10 of the 97 stars considered but evidence for the other two reactions is inconclusive. The uncertainty arises from two causes. Firstly, it is not possible to allocate a star definitely to one or other of the above three reactions; if probable errors in measurement are allowed for, allocation can be made only on a statistical basis. Secondly, since an alpha particle of energy less than about 0.3 Mev cannot be detected in a nuclear emulsion, it is possible to confuse the reactions with the four-particle reactions $N^{14}(\gamma,d3\alpha)$ and $N^{14}(\gamma,np3\alpha)$. (auth)

4944

Randal Morgan Lab. of Physics, Univ. of Penna.

IONIZATION MEASUREMENT OF $B^{10}(n,\alpha)Li^7$, by J. Rhodes, W. Franzen and W. E. Stephens. Mar. 31, 1952. 18p. (NP-3946; Technical Report No. 6)

A thin layer of boron on the wall of an A-CO_2-filled cylindrical ionization chamber exposed to slow neutrons has been used to study the ionization produced by the recoiling particles of the transmutation $B^{10}(n,\alpha)Li^7$. Polonium alpha particles were used for calibration and the ionization electron pulses were amplified and photographed on an oscilloscope screen. Calculated peak shapes, taking into account wall effect and layer thickness, were fitted to the experimental pulse-height curves, and the ionization values were deduced. The ratio of ionization produced by the He^4 and Li^{7*} recoils was observed to be 1.878 ± 0.014 compared to the energy ratio 1.7529 determined from conservation of momentum. This difference can be accounted for by the assumption that the average energy per ion pair varies with velocity. The implications of this assumption are discussed. (auth)

4945

Columbia Univ.

REACTIONS OF 370 MEV PROTONS WITH COBALT, by E. Belmont. Apr. 21, 1952. 74p. (NYO-3198)

In the bombardment of Co with 370-Mev protons the excitation spectrum of the excited nucleus before evaporation was found to have a broad maximum at about 70 Mev and a width at half maximum of 190 Mev. There is a steady decrease in yield with decreasing atomic number of the products which is gradual at first and becomes more abrupt below Ti; from Co to Ti the cross section decreases by less than a factor of 3. For a given element, the maximum yield is two units on the neutron-deficient side of stability. The plot of cross section vs. mass number is flat within a factor of two from mass 47 to 57 and decreases more sharply below mass 47; for a given mass number the maximum yield occurs one atomic number above stability. For nuclei on the neutron-deficient side of stability, the yield is constant for varying atomic number but constant isotopic number over a range of 16 mass units and 7 charge units. The high yield observed for Co^{58} is probably due to the pick-up process. The distribution of yields is qualitatively in accord with evaporation-theory predictions, but quantitative agreement is lacking.

4946

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING, by Bonnie E. Cushman. May 26, 1952. 6p. (UCRL-1775)

Excitation Function for Photoneutron Production, by L. W. Jones. Brief note is made of efforts to determine, in photoneutron production, the contribution due to high-energy quanta. Multiple Meson Production, by M. Ruderman. Brief indication is made of the possibility of isobar excitation with subsequent decay to the ground state by multiple meson emission, rather than immediate emission, when a strong external transient force affects a nucleon spin.

4947
Radiation Lab., Univ. of Calif.
DEUTERON PHOTODISINTEGRATION AT HIGH ENERGIES, by W. S. Gilbert and J. W. Rosengren. May 9, 1952. 22p. (UCRL-1792)

The reaction $\gamma + D \rightarrow p + n$ was investigated using the photon bremsstrahlung spectrum from the Berkeley 322 Mev electron synchrotron. Protons were detected by a scintillation counter telescope system consisting of three liquid scintillators, each viewed by two or three photomultiplier tubes. Two types of target system were used: high pressure, low temperature deuterium gas, and heavy water-with-water subtraction. Values for $(d\sigma/d\Omega)_c$ were determined at laboratory angles 30° – 90° for E_τ (center of mass) = 140 ± 15 Mev and 200 ± 15 Mev, and at laboratory angles of 30° – 115° for E_τ (center of mass) = 250 ± 15 Mev. The total cross sections for 140, 200, and 250 Mev were $11.8 \pm 4.1 \times 10^{-29}$, $10.0 \pm 3.0 \times 10^{-29}$, and $15.9 \pm 6.4 \times 10^{-29}$ cm^2, respectively. These uncertainties are standard deviations based on counting statistics only; there is an additional 40 percent absolute uncertainty. These cross sections are far greater than the values predicted by theories which exclude the effects of meson interaction. However, a theoretical treatment which does take the specifically mesonic interaction into account does yield cross sections of a magnitude comparable with those observed. (auth)

4948
EVAPORATION THEORY OF NUCLEAR DISINTEGRATIONS. F. Ferrari and C. Villi. Nuovo cimento (9) 9, 487-504(1952) June. (In Italian)

The Fermi gas model has been extended to high nuclear temperatures according to a mathematical procedure independent of the restrictive condition $r/\psi \ll 1$. The modification of the momentum distribution brought about by the nuclear interactions has been considered qualitatively of the same kind as that due to thermal agitation. Calculations have been carried out on the basis of the nuclear equivalent temperature τ at which the nucleon gas, having a true temperature T, may be considered as an ideal one. The relation between true and equivalent temperature has been assumed of the form $\tau = T + a\psi(\tau)$, where $a = 0.29$ is the Watanabe parameter and $\psi(\tau)$ is the Fermi function characteristic for highly degenerated gases. The evaporation process, initiated by a nucleous of energy E_0, has been studied stage by stage, taking into account the diminution of the nuclear temperature and the variation of the atomic mass number. It has been found that the nuclear energy losses can be well represented by a third-order difference relation. The energy summation formula thus derived leads to a fourth-degree equation, the solution of which gives the total number of particles evaporated from a nucleous of initial energy E_0.

4949
HIGH ENERGY PHOTODISINTEGRATION OF THE DEUTERON. Raphael Littauer and James Keck. Phys. Rev. 86, 1051-2(1952) June 15.

Bremsstrahlung from the Cornell 310-Mev electron synchrotron was allowed to strike equivalent targets of H_2O and D_2O. Charged particles emitted at a given lab. angle were detected in a coincidence-anticoincidence-counter telescope which defined their ranges and selected protons by means of their specific ionization. By subtracting the H_2O count from the D_2O count, one obtains an effect that can be due only to the process $D)\gamma,n)p$, since the contribution from the oxygen cancels out and meson production cannot give recoil protons in the ranges selected. The disintegration produced by quanta of ~165 and 230 Mev (c.m.) is discussed. The photodisintegration cross section begins to deviate from the phenomenological electric-dipole cross section in the region of the meson threshold, and thereafter rises slowly with increasing quantum energy. The total cross section at 230 Mev is of the order of 50 μb. The angular distribution of the photoprotons shows no very marked anisotropy.

4950
PHOTODISINTEGRATION OF THE DEUTERON AT HIGH ENERGIES. B. Bruno and S. Depken. Phys. Rev. 86, 1054 (1952) June 15.

Report is made of calculations of the contribution to the cross section for photodisintegration of the deuteron from processes in which a π meson is emitted by one of the nucleons, absorbs the photon, and is then absorbed by the other nucleon. Ordinary perturbation theory was used; the nucleons were treated nonrelativistically; and plane waves were used in the intermediate and final states. The ground state of the deuteron was described by a wave function of the Hulthén form. Pseudoscalar meson theory was applied. Calculations with pseudovector coupling gave total cross sections in reasonable agreement with experiment, while pseudoscalar coupling afforded too low values.

4951
EXCITATION IN HIGH ENERGY NUCLEAR REACTIONS. Norton M. Hintz. Phys. Rev. 86, 1042-3(1952) June 15.

Because of the possibility of noncapture excitation at high energies the excitation of the nucleus immediately after collision may be less than the maximum possible value which is obtained when the incident particle is captured to form a compound nucleus. It is the purpose of this note to point out that direct evidence for this may be obtained, in the case of certain nuclear reactions, by measuring the range of the struck nucleus in the target foil. This has been done for the nuclear reactions $Al^{27}(p,3pn)Na^{24}$ and $C^{12}(p,pn)C^{11}$ by determining the fractional loss of the residual nuclei, Na^{24} and C^{11}, from thin foils of the target element. From a graph of ratio of recoil to total activation vs. proton energy, it can be seen that for the C^{11} reaction the region of noncapture excitation begins at 40 to 50 Mev, and for the Na^{24} reaction, at about 65 to 70 Mev. The method of calculating the nuclear excitation for the case of noncapture excitation followed by isotropic emission of particles is indicated.

4952
(γ,α) REACTIONS ON Li^7, O^{16}, AND $Br^{79,81}$. H. Nabholz, P. Stoll, and H. Wäffler. Phys. Rev. 86, 1043-4(1952) June 15.

Li-loaded nuclear emulsions were exposed to the ~6.13-Mev γ rays from $F^{19}(p,\alpha)O^{16} + \gamma$. From the number of tracks of α particles and tritons emitted in opposite directions, the absolute intensity of γ rays, and the geometry of the arrangement, the cross section for the reaction $Li^7(\gamma,\alpha)$ was found to be $2.65 \pm 1.0 \times 10^{-29}$ cm^2. The angular distribution of the tritons with respect to the incident γ rays is given by $J(\theta) = 1-(0.1 \pm 0.09)\cos\theta$. In Kodak NT 1a plates exposed to the 17.6-Mev γ rays from the $Li^7(p,\gamma)$ reaction, the energy distribution of α-particle tracks had a peak at 7.8 Mev, corresponding to the $O^{16}(\gamma,\alpha)$ reaction leading to the ground state of C^{12}. The cross section for the $O^{16}(\gamma,\alpha)$ reaction at 17.6 Mev was determined as $1.8 \pm 0.5 \times 10^{-28}$ cm^2. The peak at 10.2 Mev is assigned to the (γ,α) reaction in $Br^{79,81}$, giving a cross section $\sigma[Br^{79,81}(\gamma_{17.6},\alpha)] = 1.2 \pm 0.5 \times 10^{-28}$

cm^2. The value calculated according to statistical theory is 4×10^{-29} cm^2.

4953

SEARCH FOR ALPHA-PARTICLES FROM THE $O^{16}(d,\alpha)N^{14*}$ REACTION. R. J. Van de Graaff, A. Sperduto, W. W. Buechner, and H. A. Enge. Phys. Rev. 86, 966-7(1952) June 15.

Studies of the gamma rays from several nuclear reactions have indicated the existence of an energy level in N^{14} at approximately 2.3 Mev. An investigation of the $O^{16}(d,\alpha)N^{14}$ reaction has been carried out in order to investigate this region of excitation in N^{14}. Two-million-volt deuterons from an electrostatic generator were employed, and the alpha particles were analyzed with a magnetic spectrograph. The region of excitation studied was from 0 to 2.8 Mev. With the exception of the ground-state group, no alpha-particle groups were found, although any group with an intensity greater than 2 percent of the ground-state group would have been observed. (auth)

4954

GAMMA-NEUTRON REACTIONS IN O^{16} AND N^{14}. R. J. Horsley, R. N. H. Haslam, and H. E. Johns. Can. J. Phys. 30, 159-64(1952) May.

The cross sections for the reactions $O^{16}(\gamma,n)O^{15}$ and $N^{14}(\gamma,n)N^{13}$ have been determined by measurement of the induced positron activities. The O cross-section curve has a slowly increasing initial portion after which it rises rapidly to a maximum peak cross section of 11.4 millibarns at 24.0 Mev. The N cross-section curve has an initial peak at about 13 Mev. Above 17 Mev, this curve increases sharply to a maximum value of 2.84 millibarns at 24 Mev. In order to explain the shape of the N curve, a relative total neutron yield curve has been determined from 12 to 20 Mev by detecting the emitted neutrons with a rhodium foil. This neutron yield curve has the same shape as the N saturated specific activity curve. The anomalous shapes of the N and O cross-section curves are explained in terms of the variation of of γ-ray absorption with energy. (auth)

4955

Q VALUES OF THE $C^{12}(d,p)C^{13}$, $Be^{9}(d,p)Be^{10}$, AND $O^{16}(d,p)O^{17}$ REACTIONS. E. D. Klema and G. C. Phillips. Phys. Rev. 86, 951-5(1952) June 15.

The Q values of the reactions listed above have been obtained by measuring the energies of the disintegration protons by means of an angular magnet whose magnetic field was measured and kept constant by a proton-magnetic-moment regulator. The energy of the incident deuterons was measured in terms of the 0.8735-Mev $F^{19}(p,\alpha'\gamma)O^{16}$ resonance. The values obtained for the above reactions are 2.732 ± 0.006 Mev, 4.591 ± 0.008 Mev, and 1.918 ± 0.008 Mev, respectively. The neutron-proton mass difference as calculated from the present data for carbon and the data given by other workers for the Q's of a closed cycle of reactions involving C^{12} and C^{13} is 0.789 ± 0.008 Mev. (auth)

4956

MEASUREMENT OF THE RATIO OF CROSS SECTIONS FOR FISSION BY THERMAL NEUTRONS OF Pu^{239} AND NATURAL URANIUM. René Cohen, Eugène Cotton, and Antoine Lévêque. Compt. rend. 234, 2355-7(1952) June 9. (In French)

The ratio $\sigma_{Pu}/\sigma_U = 203.3 \pm 4.0$ was determined by counting simultaneously the fissions produced in two thin layers of Pu^{239} and natural U by the same thermal neutron beam from the Châtillon pile. With σ_U taken as 3.915 for 0.025-ev neutrons, σ_{Pu} becomes 796 ± 16 barns.

4957

LUMINOSITY AT THE COLLISION OF SHOCK WAVES PRODUCED BY SHAPED CHARGES. J. Thibaud and D. Perrier. Nuovo cimento (9) 8, 705-12(1951) Sept. (In French)

The collision of shock waves was studied in air and argon, with a view toward ultimate utilization in initiating thermonuclear reactions. The shock waves were produced by detonation of one or two shaped charges having a convergent effect. The luminosity produced was observed for pressures lower than normal (several millimeters Hg in A) and in the presence of an electrostatic field serving to accelerate the ions produced in the collision. 38 figures.

4958

A THEORETICAL INVESTIGATION OF THE PHOTODISINTEGRATION OF THE ALPHA-PARTICLE. I. A. Gamba. Nuovo cimento (9) 8, 605-17(1951) Sept. (In English)

A discussion of four-body problems in nuclear physics is given, using group theory and isotopic-spin formalism. Since only the spin and isotopic-spin dependence of the wave function is considered, and no assumption is made on nuclear forces, the treatment is meant to be of a very general character and may constitute the basis for any discussion of four-body problems. The fundamental state of the alpha particle is discussed, and it is found that it must be a mixture of three different types of functions, which are actually evaluated. To prepare the ground for a second paper, the final states (d + d, H^3 + p, He^3 + n) are also dealt with. The electric dipole transition is introduced and some preliminary results in form of selection rules for the transition to the state d + d are given. (auth)

PARTICLE ACCELERATORS

4959

Atomic Energy Research Establishment, Harwell, Berks (England)

A NEW CALCULATION OF SLOT DEPTH FOR THE METAL LOADED LINEAR ACCELERATOR, by W. Walkinshaw and J. S. Bell. Feb. 1952. 13p. (AERE-T/R-864)

Wave-guide dimensions have been calculated using an improved trial function for the electric field. The linear variation function includes, as well as the usual trigonometric terms, functions which have the correct singularities on the sharp edges. (auth)

4960

Radiation Lab., Univ. of Calif.

UNIVERSITY OF CALIFORNIA RADIATION LABORATORY 6.4 BEV BEVATRON RF SYSTEM, by C. N. Winningstad, D. Paxson, O. Anderson, Q. Kerns, and J. Riedel. Apr. 15, 1952. 43p. (UCRL-1750)

The UCRL bevatron r-f system utilizes the magnet current as the major source of frequency-determining information for the primary frequency generator. Especially designed Ferroxcube III saturable reactors are the basis of controlling the primary frequency generator's resonant frequency with the magnet current. The 450-$\mu\mu$f capacity of the accelerating anode, or drift tube, is automatically resonated with Ferroxcube III reactors also, in order that the final r-f amplifier plate dissipation rating need be only the order of 10 kw to obtain the 22.3-kv r-f level. (auth)

4961

Radiation Lab., Univ. of Calif.

A SIMPLIFIED CYCLOTRON BEAM SNOUT, by T. M. Putnam. June 4, 1952. 11p. (UCRL-1827)

A simple snouting arrangement for a cyclotron beam is described. The beam is brought out from the fringing field of the magnet through an iron snout which reduces the field sufficiently to straighten out the beam path. A method of collimating to produce a fairly homogeneous beam is shown and some preliminary results are presented. (auth)

4962

DC BIASING OF AN ELECTRON SYNCHROTRON. E. G. Muirhead and B. M. Spicer. Rev. Sci. Instruments 23, 311(1952) June.

With a synchrotron employing d-c bias it has been possible to obtain an injection efficiency at least equal to that of an equivalent a-c-operated betatron when the magnet is operated with almost complete back biasing by means of a simple form of magnetic field correction. A coil, wound on one pole only and consisting of a few turns operating into a small variable resistance, supplies the necessary ampere turns. The optimum number of ampere turns required in any instance is approximately proportional to the bias current used. From a consideration of the magnitudes at injection time of the currents in primary and secondary coils, it seems likely that this method corrects for the radial field produced by the unbalance between the resultant magnetizing currents around the top and bottom poles.

4963
POSSIBILITY OF FREQUENCY MULTIPLICATION AND WAVE AMPLIFICATION BY MEANS OF SOME RELATIVISTIC EFFECTS. K. Landecker. Phys. Rev. 86, 852-5 (1952) June 15.

A method is proposed of converting the frequency of an electromagnetic wave to a higher frequency by reflection from an electron cloud moving with relativistic velocity. Such an electron cloud can be realized by compressing all or part of the electron beam of an electron accelerator into one or more groups. It is shown that there is a gain of wave energy arising from the relativistic law of reflection of a wave which is reflected from such a cloud. It is also shown on the basis of Bailey's relativistic electro-magneto-ionic theory that under certain circumstances the reflection from a moving slab of electrons may be increased considerably if the slab moves through a longitudinal or transverse magnetic field. It is estimated that a wave of length 1 mm and of a power at least one milliwatt can be generated by reflecting a wave of length 3 cm from the beam of a small betatron. Equipment is being designed to test this prediction experimentally. (auth)

RADIATION ABSORPTION AND SCATTERING

4964
Los Alamos Scientific Lab.
ELASTIC SCATTERING OF PROTONS AND NEUTRONS BY HELIUM, by D. C. Dodder and J. L. Gammel. [nd] 23p. (AECU-2122; LADC-1205)

Proton-alpha elastic scattering experiments at 5.81 and 9.48 Mev are analyzed in terms of phase shifts and the results, together with earlier ones at lower energies, are used to compute the logarithmic derivatives of the wave functions at a radius of 2.9×10^{-13} cm. These logarithmic derivatives, for $P_{1/2}$ and $P_{3/2}$ states, are found to be linear functions of the energy. From the behavior of the logarithmic derivatives the widths and positions of the $P_{1/2}$ and $P_{3/2}$ energy levels are determined, the most striking results being the large splitting of the two levels and the very broad width of the $P_{1/2}$ level. These results are compared with neutron-alpha experiments and are found to be in sufficiently good agreement to support the conclusions about the $P_{1/2}$ level which differ from those previously expected. Small negative D-wave phase shifts are found in the proton-alpha experiments which also show evidence of an inverted doublet spin-orbit splitting. (auth)

4965
[Oak Ridge National Lab.]
ENERGY ABSORPTION OF CAPTURE GAMMAS, by H. L. F. Enlund. June 11, 1952. 6p. (CF-52-6-99)

The heating produced by the absorption of γ rays arising from thermal-neutron capture is predicted. A curve showing the distribution of heating in inconel metal is given. (auth)

4966
Radiation Lab., Univ. of Calif.
A STUDY OF THE PICK-UP PROCESS IN PROTON-DEUTERON SCATTERING (thesis), by Alexander Bratenahl. June 2, 1952. 75p. (UCRL-1842)

To account for the unexpectedly large yield of high-energy deuterons produced by high-energy proton or neutron bombardment of nuclei, a mode of production has been proposed in which a nucleon is transferred from the target nucleus to the incident nucleon, the pair emerging as a deuteron. This transfer or rearrangement process has been termed pick-up. The present experiment is concerned with a test based on a connection between the angular distribution of deuterons and the energy dependence of the yield and consists of a set of observations on elastic-recoil deuterons from a deuterated-paraffin target under proton bombardment. Measurements are made over the angular range 0 to 20° at proton energies of 95, 110, and 138 Mev. The experiment is conducted in the magnetic field of the 184-inch Berkeley synchrocyclotron where use is made of the field to separate the deuterons from incident and scattered protons. The particles are detected in photographic emulsions and identified by the combination H and range. The apparatus is essentially a thirty-six channel, 180° magnetic-focus particle spectrometer. The experimental yield is only half that predicted by theory, but the form of the angular distribution and energy dependence are consistent with the pick-up hypothesis. As a secondary result of this experiment, the energy distribution of protons as received on an internal cyclotron target is measured. It is found that the radial oscillations in the circulating beam have a mean amplitude of about three inches and the effect of this motion is to depress the energy at a given target radius below that expected. (auth)

4967
RELATIVE PAIR PRODUCTION CROSS SECTIONS IN THE ENERGY REGION 50 TO 300 MEV. C. R. Emigh. Phys. Rev. 86, 1028-35(1952) June 15.

A cloud-chamber survey has been made of pairs produced in Al, Ag, Au, and Th foils by an x-ray beam from the 300-Mev betatron. By comparing the pairs produced in two of the foils mounted to intercept the same x-ray beam, values of the relative pair-production cross sections for Ag to Al, Au to Al, and Th to Al were found to be, respectively, 3.4 ± 1.4, 7.9 ± 1.5, and 11.7 ± 1.7 percent low compared with the Bethe-Heitler theory predictions. The results are consistent with a correction factor to the theoretical pair cross section given by $[1-(1.4 \pm 0.1)10^{-5}Z^2]$. The calculated number of Compton electrons between 50 and 200 Mev expected from the Al foil is 1201, from the Ag foil is 355, and from the Au foil is 113. The observed numbers with statistical errors indicated are, respectively, 1170 ± 40, 354 ± 30, and 70 ± 18. (auth)

4968
AN HYSTERESIS EFFECT IN THE TRANSMISSION OF ELECTRONS THROUGH THIN DIELECTRIC FOILS. Paul H. Owen and C. Sharp Cook. Phys. Rev. 86, 961-3(1952) June 15.

The relative transmission of monoenergetic electrons through a dielectric foil suspended in vacuum has been observed to depend upon the previous history of the foil. A plot of this transmission against energy of incident electrons shows something resembling a type of hysteresis loop. Experiments are discussed which give evidence that this hysteresis loop is produced through the collection of negative charge within the foil. (auth)

4969
SCATTERING OF PLANE WAVES BY SOFT OBSTACLES. III. SCATTERING BY OBSTACLES WITH SPHERICAL AND CIRCULAR CYLINDRICAL SYMMETRY. Elliott W. Montroll and J. Mayo Greenberg. Phys. Rev. 86, 889-98 (1952) June 15.

A new variational method is devised for obtaining the "best" parameters for trial wave functions of a given type for insertion into the integral equation for the scattering of scalar plane waves by obstacles with spherical and cylindrical symmetry. The variational procedure is applied to the determination, in the least square sense, of the square-well potential which most closely approximates the potential under consideration for a given propagation constant ($k_0 = 2\pi/\lambda_0$) of the incident wave. We then use as a trial function in the scattering integral equation the sphere (or cylinder) wave function (with the "best" parameters) which was derived in the first two papers of this series. The differential and total scattering cross sections for scattering by Gaussian, exponential, and screened Coulomb potentials are obtained in simple closed forms. The Born approximation predicts the ratio of the total scattering cross section to πb^2 (where b is qualitatively the effective range of the scatterer) to be a monotone increasing function of $2\pi b/\lambda_0$, while in our theory it is a bounded function. The main advantage of the procedure developed in this paper is that, while it is superior to the Born approximation, especially for large b/λ_0, it is equally simple to apply. (auth)

4970

INELASTIC SCATTERING OF PROTONS FROM NICKEL. Ralph Ely, Jr., A. J. Allen, J. S. Arthur, R. S. Bender, H. J. Hausman, and E. M. Reilley. Phys. Rev. 86, 859-60(1952) June 15.

By use of the equipment developed for the precision scattering project at the University of Pittsburgh, inelastic scattering of 8-Mev protons from a thin nickel target has been observed at 90°. The energy levels obtained for natural nickel are 1.344, 1.479, 2.186, 2.326, 2.501, 2.660, 2.814, 2.946, 3.081, 3.161, 3.226, 3.308, 3.462, 3.575, 3.646, 3.773, 3.823, 3.944, 3.979, and 4.066 Mev. At present, only the three levels 1.344, 1.479, 2.501 Mev can be assigned to Ni^{60} from comparison with beta-decay of Co^{60}. (auth)

4971

THE SCATTERING OF FAST NEUTRONS BY WOLFRAM. C. E. Mandeville, C. P. Swann, and F. J. Seymour. Phys. Rev. 86, 861-3(1952) June 15.

Employing good geometry, homogeneous fast neutrons of energy 4.3 Mev, supplied by the d-d reaction in the Bartol Van de Graaff statitron, have been scattered in tungsten. Using binocular microscopes and Eastman NTA plates, twenty-four thousand fields of view were examined to obtain 2700 acceptable recoil proton tracks. The distribution in energy of the inelastically scattered neutrons is obtained. It is roughly estimated that the inelastic scattering cross section at 4.3 Mev is less than three-fourths as great as the elastic one. (auth)

4972

THE OPPENHEIMER APPROXIMATION FOR THE SCATTERING OF ELECTRONS. E. Corinaldesi, L. Trainor, and Ta-You-wu. Nuovo cimento (9) 9, 436-9(1952) May. (In English)

Considerable confusion seems to exist concerning a so-called "prior-post" ambiguity in the matrix elements for the transition probabilities in Oppenheimer's theory of electron scattering by H and He atoms. The method is formulated in the present note in such a way that this ambiguity can be interpreted. The "prior" and "post" matrix elements are shown to represent two similar, but not identical, approximations.

4973

THE THEORY OF THE IMPULSE APPROXIMATION. Saul T. Epstein. Phys. Rev. 86, 836-7(1952) June 15.

An integral equation is derived for the scattering of a neutron by a bound proton. This equation has the impulse approximation as the first approximation to its solution. The connection between the impulse approximation and the Fermi approximation is discussed and clarified. (auth)

4974

AN INVESTIGATION INTO THE NUCLEAR SCATTERING OF HIGH ENERGY PROTONS. Kantilal M. Gatha and R. J. Riddell, Jr. Phys. Rev. 86, 1035-9(1952) June 15.

The angular distributions of high-energy protons, elastically scattered from various nuclei, have been considered theoretically. For this purpose, the optical model of the nucleus, hitherto developed on the basis of the nuclear scattering of high-energy neutrons, has been suitably modified to account for the proton scattering. Appropriate proton wave equations have been established and solved exactly. However, these solutions have been found unsuitable for numerical computations. Next, the WKB and the Born approximations have been used, within their respective regions of validity, to yield appropriate expressions for the differential scattering cross section. Finally, the theoretical and the experimental diffraction patterns for the nuclear scattering of 340-Mev protons have been compared. It has been found that the above nuclear model gives only an approximate account of such a scattering. It is further indicated that the effective nuclear radii, appropriate for this energy, are about 10 percent smaller than those calculated on the basis of the nuclear scattering of 90-Mev neutrons. (auth)

4975

NEUTRON-PROTON SCATTERING AT 156 ± 3 MEV. T. C. Randle, A. E. Taylor, and E. Wood. Proc. Roy. Soc. (London) A213, 392-9(1952) July 8.

The angular distribution for neutron-proton scattering at 156 ± 3 Mev has been determined for center-of-mass scattering angles between 50 and 178°. The ratio $\sigma(\pi)/\sigma(\frac{1}{2}\pi)$ is 5.0 and the minimum value of the differential cross section occurs at an angle between 75 and 85°. (auth)

4976

RANGE-ENERGY CURVE OF SLOW ELECTRONS IN NUCLEAR EMULSION. Bernard Gauthe and Jacques-Marcel Blum. Compt. rend. 234, 2189-91(1952) May 26. (In French)

Histograms of range vs. number of tracks have been determined for the electrons liberated photoelectrically in nuclear emulsions by monochromatic Ag and Zr x rays. Four new points have been located on the range-energy curve below 20 kev.

4977

REABSORPTION OF SCATTERED RADIATION IN AN IONIZATION CHAMBER. H. Tellez-Plasencia and P. Théron. J. phys. radium 13, 297-8(1952) May. (In French)

In preceding papers (J. phys. radium 9, 230(1948); 11, 93(1950)) the authors derived equations for the degradation of energy of an x-ray beam in a gas, including corrections for the excess ionization produced by reabsorption of the fluorescence radiation. These are now applied to the analogous case of reabsorption of radiation modified by the Compton effect. This correction may be important when the photoelectric absorption is weak with respect to the scattering.

RADIATION EFFECTS

4978

Illinois Univ.

PROGRESS REPORT [ON] RADIATION DAMAGE AND RECOVERY IN Cu, Ag, Au, Ni, AND Ta, by J. W. Marx, H. G. Cooper and J. W. Henderson. July 1, 1952. 33p. (AECU-2118)

The electric resistivity changes induced by the 12-Mev deuteron bombardment of Cu, Ag, Au, Ni, and Ta foils were determined as functions of the integrated flux. Bombardments were carried out at about −140° and −150°C, and differences

in the two sets of measurements traced to a thermal recovery process which was proceeding with measurable velocity even at −165°C. This low-temperature reaction was characterized by an activation energy of 0.2 ± 0.5 ev for Cu, Ag, and Au, and one of 0.3 ± 0.1 ev for Ni and Ta. It is suggested that the migration of vacancy pairs offers a reasonable model for the initial recovery process, although other mechanisms are also discussed. (auth)

4979
FLUORESCENCE PRODUCED BY ALPHA PARTICLES IN STILBENE. M. Ageno and G. Cortellessa. Nuovo cimento (9) 9, 196-8(1952) Feb. (In Italian)

Recent investigations of the production of fluorescence by transport of energy from the exciting particle through several millimeters of liquid have been extended to solid crystalline trans-stilbene bombarded with α particles. As before, the intermediate action of ultraviolet light as energy carrier was shown.

4980
KINETICS OF DECOLORATION OF GLASSES COLORED BY IRRADIATION IN THE CHATILLON PILE. Guy Mayer and Jules Guéron. J. chim. phys. 49, 204-12(1952) Apr. (In French)

Absorption spectra of samples of glass, silica, and quartz colored by pile irradiation, then heated to decoloration, were studied from 200 to 2000 mμ. An attempt was made to analyze the spectra of both exposed and heated samples into bands relative to the different types of centers, and the kinetics of disappearance of these centers was studied. An attempt to interpret the numerical data as to absolute reaction velocity, energy of activation, and reaction order was made with the aid of the theory of alkaline halides.

4981
Argonne National Lab.
RADIATIONS OF 6.7d U^{237}, by F. Wagner, Jr., M. S. Freedman, D. W. Engelkemeir, and J. R. Huizenga. May 14, 1952. Decl. June 30, 1952. 16p. (AECD-3414; ANL-OCS-275)

The radiations of U^{237} have been studied using a magnetic-lens beta-ray spectrometer and scintillation spectrometers for betas and gammas singly and in coincidence. A beta with an end point energy of 245 kev was found along with evidence for the existence of lower-energy components. Gammas of energy 27, 42, 49, 59, 166, 208, 269, 334, 431, and 467 kev were found, and probably a gamma of 102 kev. The decay scheme constructed gives a total decay energy for this isotope of 512 kev. (auth)

RADIOACTIVITY

4982
Argonne National Lab.
HALF-LIVES OF Eu^{152}, Eu^{154} AND Sm^{151}, by D. G. Karraker, R. J. Hayden, and M. G. Inghram. June 1952. 2p. (AECU-2107; UAC-591)

The half lives of Eu^{152}, Eu^{154}, and Sm^{151} were measured directly by mass spectrometric methods. In each case the half life was determined by the change with time of the isotopic consititution of samples containing an appreciable percentage of the nuclide under investigation. For Eu^{152} and Eu^{154}, the sample used for the determination of the half lives was a normal irradiated Eu sample. The half life of Sm^{151} was determined by the change in isotopic abundance of Sm^{151} in a sample of purified fission-produced Sm.

4983
Ames Lab.
RADIATION STUDIES, STUDIES OF NUCLEI, AND THEORETICAL PHYSICS, sects.II, III, and IV of PROGRESS REPORT IN PHYSICS FOR THE PERIOD JULY 1, 1951 TO DECEMBER 31, 1951, by G. W. Fox, J. F. Carlson, G. C. Danielson, D. E. Hudson, E. N. Jensen, J. K. Knipp, J. M. Keller, L. J. Laslett, S. Legvold, G. Miller and D. Zaffarano. May 1, 1952. 16p. (ISC-224(sects.II, III, and IV))

A β spectrum having a maximum energy of 0.26 ± 0.02 Mev and a half life of 24.8 ± 0.5 days has been assigned to P^{32}, formed by the reaction $S^{32}(n,p)P^{32}$. A careful re-examination of the secondary-electron spectrum from Pr^{142} has confirmed the conclusion that only one γ ray is present; the broad distribution of electrons at the low-energy end of the spectrum is due to bremsstrahlung. The presence of a large number of photodeuterons produced by γ irradiation of Cu has been demonstrated; the distribution of the curvatures in cloud-chamber tracks indicates a deuteron-to-proton ratio of 0.76. Equipment completed or conspicuously improved includes the intermediate-image spectrometer, the multichannel pulse-height analyzer, the kevatron ion source, the ionization chamber for low-energy ionization experiments, and the pair spectrometer. Brief summaries are given of the status of work by the theoretical group on the following problems: ionization and excitation by electrons; ionization of heavy particles in their passage through a gas; radiative π-μ meson decay; specific heats of rare-earth metals and the effects of electrostatic crystalline fields on the ionic energy levels of 4f electrons; nuclear photoeffects; steady-state flow problems; and low-energy scattering and excitation.

4984
North American Aviation, Inc.
CONTRIBUTION BY CHEMICAL ELEMENT TO THE TOTAL BETA ACTIVITY OF FISSION PRODUCTS, by F. J. Keneshea, Jr. and A. M. Saul. Issued June 13, 1952. 29p. (NAA-SR-187)

Curves have been plotted showing the relative contribution of each of the principal chemical elements formed in fission of U^{235} to the gross beta activity as a function of decay time and for several irradiation times. (auth)

4985
DETERMINATION OF THE RADIOACTIVITY OF A DELIANOVA PEGMATITE BY MEANS OF NUCLEAR EMULSION EXPOSED TO LAYERS OF PULVERIZED AND COMPRESSED ROCK AND TO THIN SECTIONS. S. Milone Tamburino and A. Stella. Nuovo cimento (9) 9, 253-68 (1952) Mar. (In Italian)

The measurement of the quantity of radioactive elements contained in a rock is performed by exposing the nuclear emulsion to a layer of pulverized and compressed rock. Studying a pegmatite of Delianova (Reggio Calabria), a concentration of 2.9×10^{-5} g of U per gram of pegmatite has been obtained. The identification of radioactive ores contained in the rock and the approximated determination of their radioactivity have been performed using polished thin sections. The main radioactive minerals of this pegmatite are uraninite and torbernite. (auth)

4986
THE β-SPECTRUM OF RaD. A. A. Jaffe and S. G. Cohen. Phys. Rev. 86, 1041-2(1952) June 15.

The radioactive decay of RaD (Pb^{210}) has been investigated by introducing it in the form of lead tetramethyl vapor into a proportional counter. The pulse distribution obtained with a single-channel pulse analyzer is shown. The peak due to the sum of the β's and highly-converted 46.7-kev γ's is much broader than that obtained with an external RaD source, and the maximum occurs at an energy 2.7 ± 0.5 kev greater than 46.7, indicating the existence of a maximum in the β spectrum. The β contribution to the curve was found by subtraction and a Fermi plot for an allowed transition gives a good straight line from 3 kev to 13.0 kev. Extrapolation gives an end point corresponding to a maximum energy of 15.7 kev. From several determinations, the mean value for the end point was found to be 16.7 ± 1 kev. Examination of

the low-energy part of the pulse distribution (no converted γ's) also gave evidence for the existence of a maximum at 2.4 kev. The results indicate a branching in the β decay, so that in at least 10% of the disintegrations a β spectrum of maximum energy 55.6 kev is followed by a 7.8-kev γ ray.

4987

HALF-LIFE AND RADIATIONS OF Tc^{100}. G. E. Boyd, Q. V. Larson, and G. W. Parker. Phys. Rev. 86, 1051(1952) June 15.

A 70 ± 2-sec positron activity noted in deuteron and proton bombardment of Mo^{100} has been found to be due to the presence of F^{17} resulting from deuteron reactions on small amounts of O remaining in the target after reduction of $Mo^{100}O_3$ to Mo metal. In a search for Tc^{100}, purified Tc metal and TcO_2 were irradiated in the Oak Ridge graphite pile. The decay of the induced activity was measured through varying thicknesses of Al and Pb using a mica end-window β-proportional counter as a detector and strip chart recording. It is concluded that Tc^{100} decays with a 15.8 ± 0.2-sec half life and that β rays of 2.8 ± 0.2-Mev maximum energy energy are emitted together with γ's. Almost certainly the β and γ spectrum of Tc^{100} is complex. A search was also made for a possible long-lived isomeric state of Tc^{100} with negative results.

4988

NUCLEAR MATRIX ELEMENTS IN THE THEORY OF BETA-DECAY. Henry Brysk. Phys. Rev. 86, 996-1005 (1952) June 15. (cf. NSA 6-431)

An approach has been developed whereby the nuclear matrix elements can be calculated for the odd-A and half of the even-A beta-radioactive nuclei. The designation of nuclear states is made in accordance with the Mayer shell model and its extension by Nordheim to the even-A nuclei. The transforming nucleon is assigned the wave functions of a Dirac particle in a "square-well" potential representing the nuclear "core." Expressions for the matrix elements have been determined and compared with the data. Consistent agreement is found for the tensor interaction. (auth)

4989

DOUBLE BETA-DECAY OF Sn^{124}. R. M. Pearce and E. K. Darby. Phys. Rev. 86, 1049-50(1952) June 15.

A source consisting of a tin foil containing 95% Sn^{124} was placed between two scintillation counters. Coincident β particles were detected in the thick anthracene crystals. The amplitudes of two coincident pulses from the detectors were added electronically, and the pulse representing this sum was displayed on an 18-channel "kicksorter." Since the amplitudes of the detector pulses are proportional to the energy of the β particles, the added pulses from double β events were expected to have constant amplitude (assuming no neutrino emission). This would result in a "peak" on the graph of the number of coincidences vs. the sum of energies of the two β particles. No trace of a peak was found, and a lower limit of 0.3 to 0.6×10^{17} yr is set for the half life of the double β decay of Sn^{124}.

4990

DETERMINATION OF PROBABILITIES OF TRANSITION BY K CAPTURE AND POSITRON EMISSION IN Zn^{65} WITH GEIGER-MUELLER COUNTERS. John Keene Major. Compt. rend. 234, 2276-7(1952) June 4. (In French)

Absolute and coincidence measurements of the β, x, and γ rays of Zn^{65} showed that 44.8 ± 2.1% of the K capture go to the 1.1-Mev excited state of Cu^{65} and that 2.5 ± 0.1% of all the disintegrations proceed by positron emission. The absence of β-γ coincidences suggests that all the positron decays are to the ground state. The branching ratio P_K/P_+ of 21.3 ± 1.4 is in agreement with cloud-chamber measurements and, in the first approximation, with a theoretical value for a twice-forbidden transition ($\Delta J = 1$, $\Delta L = 2$).

4991

INTERNAL-CONVERSION RADIATION OF Th^{232}. G. Albouy. J. phys. radium 13, 309-10(1952) May.

A statistical examination of α tracks with and without associated electrons of purified Th, as a citrate complex in Ilford G5 emulsion, showed that 20% of the Th → MsTh1 (Ra^{228}) transitions go to a 75-kev excited state of MsTh1. The L/M conversion ratio could not be determined. Several tracks associated with two electrons were observed, but in too few number to be attributed to any particular phenomenon.

4992

THE DISINTEGRATION SCHEME OF K^{40}. M. Paganelli and G. Quareni. Nuovo cimento (9) 9, 324-35(1952) Apr. (In Italian)

Details of the experiment briefly reported in Phys. Rev. 86, 423-4(1952) (NSA 6-4268) are presented.

RARE EARTHS AND RARE-EARTH COMPOUNDS

4993

PARAMAGNETIC PROPERTIES OF SEVERAL HEXABORIDES OF RARE EARTHS. René Benoit and Pierre Blum. Compt. rend. 234, 2428-30(1952) June 16. (In French)

Magnetic susceptibilities of CeB_6, NdB_6, GdB_6, and YbB_6 were determined between 0 and 1000°C. Curie points, magnetic moments, and screening constants are discussed.

SPECTROSCOPY

4994

SECOND-ORDER RADIATIVE CORRECTIONS TO HYPERFINE STRUCTURE. Norman M. Kroll and Franklin Pollock. Phys. Rev. 86, 876-88(1952) June 15.

In this paper the effect of second-order radiative displacements of the energy levels of a bound electron on hyperfine-structure separation is examined, and a correction to the Fermi formula for s levels is obtained. The treatment is based on an approximate evaluation of a finite, completely renormalized, and exact expression for the second-order energy. The correction, which is restricted to atoms of small αZ, is found to be $[\alpha/2\pi - \alpha^2 Z(\frac{5}{4} - \ln 2)]E_H$, where E_H is the Fermi energy. The effect of this and other corrections to the Fermi formula on the presently accepted value of the fine-structure constant is discussed. (auth)

THEORETICAL PHYSICS

4995

A UNIFIED FIELD THEORY WITH VARYING CHARGE AND REST-MASS. H. C. Corben. Nuovo cimento (9) 9, 235-52 (1952) Mar. (In English)

It is shown that the neutron and proton may be treated as different states of the one particle in a classical field theory by ascribing to them an extra degree of freedom in terms of which to specify the electric charge. This may be done in the framework of a unified field theory which is a modification of the theory of Kaluza and Klein, Kaluza's constant a being chosen to give the correct mass difference of neutron and proton. Without the explicit introduction of meson potentials or any free parameters, it then follows that there exists a short range ($\sim 10^{-13}$ cm) attraction between neutron and proton, and a modified coulomb interaction between two protons. The possibility of charge exchange between nucleons is a consequence of the field equations and the geodesic equations of motion. A photon may acquire a charge and rest-mass when extremely close to a charged particle, and the possibility arises for the formation of systems of such charged photons with rest energies of order 100 Mev. Without any special assumptions about the fifth coordinate x^5 it follows that in the linear approximation the electromagnetic potentials satisfy Maxwell's equations and are independent of x^5 when all other potentials are neglected. Correspondence

with classical electrodynamics is established in the limit $a \to 0$. (auth)

4996
A NOTE ON THE ABSORBER THEORY OF RADIATION. Peter Havas. Phys. Rev. 86, 974-5(1952) June 15.

The Wheeler-Feynman theory, starting with fields symmetric in time, obtained the Lorentz-Dirac equations of motion, which use retarded fields only, together with a condition on the total field of all particles in the universe. It is shown that if the field acting on a particle produced by all other particles is static but not zero, no motion of the system satisfying this condition exists. Some implications of this result for the physical interpretation of the Wheeler-Feynman theory are discussed. (auth)

4997
THE DYNAMICAL THEORY OF MAGNETIC MONOPOLES. S. Shanmugadhasan. Can. J. Phys. 30, 218-25(1952) May.

The theory of electric charges and magnetic monopoles has been set up by Dirac by expressing the electromagnetic field tensor in terms of one four-potential and of the variables describing the strings attached to each magnetic monopole. In this reformulation of Dirac's theory the field tensor is expressed in terms of two four-potentials, one corresponding to charges and the other to monopoles, and the action principle for the equations of motion is set up in terms of the two four-potentials and of the tensors dual to them. Thus there is formal symmetry as far as is possible in the treatment of the charges and the monopoles. Also the mathematics is direct and neat. Though the physical content is the same as that of Dirac, a natural generalization of the Fermi form of electrodynamics subject to the restriction that the same particle cannot have both charge and monopole is obtained here. (auth)

4998
SPINORS IN THE DYNAMICAL THEORY OF SPINNING PARTICLES. S. Shanmugadhasan. Can. J. Phys. 30, 226-34(1952) May.

The correspondence between self-dual six-vectors and symmetric spinors of the second rank is used to put into spinor form the rotational equations of motion of a particle analogous to a pure gyroscope or to a symmetrical top. These equations are then split up into an equivalent system of equations in terms of spinors of the first rank. The lagrangian of each system is set up, and the canonically conjugate variables obtained from it in terms of covariant spinors. But the canonical variables, being not all independent, lead to weak equations in the sense of Dirac. Therefore, Dirac's generalized hamiltonian dynamics is used in the canonical formulation in terms of Poisson brackets. The detailed discussion of the symmetrical top case shows that, though the fundamental Poisson brackets for the total spin angular momentum and the spin are the usual ones, those Poisson brackets involving the derivative of the spin are not unique. (auth)

4999
ON THE UNIVERSAL FERMI-TYPE INTERACTION. II. E. R. Caianiello. Nuovo cimento (9) 8, 749-67(1951) Oct. (In English)

A universal interaction is sought among all known fermions based on invariance under the extended Lorentz group which will exclude all processes not occurring in nature. Two mutually exclusive interactions appear ultimately to be the only ones consistent with certain plausible criteria of simplicity. The two possible interactions are proved to yield identical numerical answers in the case of free fermions; one at least of them is in excellent agreement with all the experimental evidence available thus far. (auth)

5000
PROBLEM OF TRANSFORMATION OF VARIABLES IN DISTRIBUTION THEORY. S. Albertoni and M. Cugiani. Nuovo cimento (9) 8, 874-88(1951) Nov. (In Italian)

The principal aim of this work consists in the study of the variables transformation problem in the frame of Schwartz's distribution theory. In particular several formulas concerning Dirac's "singular" functions, frequently used in quantum theory, are proved. (auth)

5001
ON THE GENERAL THEORY OF DAMPING IN QUANTUM MECHANICS. M. Schönberg. Nuovo cimento (9) 8, 817-42(1951) Nov. (In English)

A general form of the equation of Heitler and Peng (Proc. Cambridge Phil. Soc. 38, 296(1942)), valid for time-dependent interactions, is given. The relations between the generalized Heitler-Peng and Schwinger theories of damping are examined in detail. A form of the damping theory given previously by the author is generalized to the case of any time-independent interaction. It is shown that the generalized form of the Heitler-Peng treatment of the damping may be used to develop a form of stationary perturbation theory applicable to cases in which it is not possible to set up a correspondence between unperturbed and perturbed stationary states. (auth)

5002
ON THE QUANTUM THEORY OF FIELDS. II. G. Wataghin. Nuovo cimento (9) 9, 208-9(1952) Feb. (In English)

Production of mesons in high-energy collisions is treated with the assumption of a fundamental length and a new uncertainty principle.

5003
PHYSICAL APPLICATIONS OF THE RESOLVENT OPERATORS. I. ON THE MATHEMATICAL FORMALISM OF FEYNMAN'S THEORY OF THE POSITRON. M. Schönberg. Nuovo cimento (9) 8, 651-82(1951) Sept. (In English)

The resolvent operators of the theory of linear functional equations are applied to the quantum formalism in general and especially to the Feynman formulation of the hole theory. A generalization of the resolvent operators is given in order to treat problems with time-dependent hamiltonians. It is shown that Feynman's formulation amounts to considering divergent waves for the positive kinetic energies and convergent waves for the negative kinetic energies, in the propagation kernel. Expansions of the propagation kernels are derived from the resolvent, without using Feynman's integral equation which leads to difficulties. A relativistically invariant resolvent is defined in the theory of quantized interacting fields. An operator related to the resolvent describes a new kind of collision which can be used in the theory of the ground state of atomic nuclei. (auth)

5004
ON THE QUANTUM THEORY OF FIELDS. I. G. Wataghin. Nuovo cimento (9) 8, 592-4(1951) Aug. (In English)

A modified form of the quantum theory of fields, similar to the S-matrix theory but differing from other formulations in many respects, is presented. Transitions in collisions are limited to those compatible with the assumption of a fundamental unit of length. Many virtual processes giving rise to so-called renormalizations of the charge or of the masses are eliminated. The stationary states and the effects of "external fields," corresponding to long-range interactions, are deduced by means of the perturbation theory following the Dirac-Fock-Podolsky "many-time" formalism. The supplementary magnetic moments of the electron or of the nucleon and the Lamb shift come into play only during the effective interaction with an electro mag-

netic field. As an example, the Compton effect in the interaction between photon and electron-positron fields is calculated.

5005
FERMION TYPES AND ENSUING SELECTION RULES. E. R. Caianiello. Nuovo cimento (9) 9, 336-50(1952) Apr. (In English)

The notion of type of a fermion is reexamined. Inconsistencies of previous treatments are eliminated, and a criterion is proposed to determine the types allowed under a given inversion. It is shown that, if the hypothesis is accepted that a universal Fermi-type interaction exists, the conditions which this hypothesis sets on the fermion types, together with the information deriving from the known interactions of fermions with bosons, a fairly definite determination of the fermion types is arrived at. Many new selection rules follow which are effective in processes in which fermions change their nature. It is intended this way to establish an independent check on the possibility of a universal interaction, at least so far as it is assumed to derive from simple requirements of relativistic invariance: it would have to be rejected if deductions derived from these considerations should prove inconsistent with experiment. Alternatively, the information gathered from such hypothesis, that is, the knowledge of the fermion types, would play in the study of elementary phenomena a role similar to the one played by the knowledge of bosons parites. The results obtained thus far seem to favor the second alternative. (auth)

TRACER APPLICATIONS

5006
MIGRATION OF S^{35} IN NaCl SUBJECTED TO AN ELECTRIC FIELD. Marius Chemla. Compt. rend. 234, 2064-6(1952) May 19. (In French)

The S^{35} produced by fast neutrons in NaCl migrate toward the anode when a potential difference is applied to the crystal. The ratio of diffusion coefficient to ion mobility has been measured between 650 and 775°C. Einstein's equation does not apply.

WAFFLER H
6-4952
WAGNER F JR
6-4981
WALKER DARCY
6-4902
WALKER W D
6-4824
WALKINSHAW W
6-4959
WALLACE W E
6-4796
WATAGHIN G
6-4829 6-5002 6-5004
WATSON K M
6-4901
WEHNER PHILIP
6-4725 6-4726
WELCH W M MANUFACTURING CO
6-4868
WEST EDWARD S
6-4718
WEST PHILIP W
6-4734
WHITAKER W W
6-4706
WHITCOMBE DAVID W
6-4915
WHITE J C
6-4751
WHITE M R
6-4714
WILDHORN SORREL
6-4771
WILDING J L
6-4706
WILKINS J J
6-4943
WILSON E BRIGHT JR
6-4913
WILSON HERBERT S
6-4715
WILSON WILLIAM JR
6-4786
WINGO W J
6-4890
WINNINGSTAD C N
6-4960
WITTEN VICTOR H
6-4711
WITTWER S H
6-4716 6-4717
WOOD E
6-4975
WOODBURY D T
6-4761
WOUTERS L
6-4919
WUCHER J
6-4797
YERGIN P F
6-4773
YOUNG EDWARD L
6-4833
YUSTER P H
6-4730
ZACKAY VICTOR F
6-4780
ZAFFARANO D
6-4803 6-4804 6-4953
ZINN W H
6-4938
ZOBLE W
6-4924

NUMERICAL INDEX OF REPORTS

Numerical Index of Official Atomic Energy Reports with Indications of Their Availability

This list in the individual issues of Volume 6 supplements the Numerical Index of Reports with Indications of Their Availability which appears in NSA, Volume 5, No. 24. As reports are in manuscript form when abstracted for NSA, there may be some delay before the reports will be available at the Depository Libraries. The notation NSA in the Availability column indicates the appearance of a report in its entirety in NSA. In general, this list refers only to those reports abstracted in issues preceding the current one. Orders for items for which prices are indicated should be directed to:

Office of Technical Services
Department of Commerce
Washington 25, D. C.

Abbreviations used below are:

NSA - NUCLEAR SCIENCE ABSTRACTS
ADD - ABSTRACTS OF DECLASSIFIED DOCUMENTS the predecessor of NSA
NNES - National Nuclear Energy Series, published by the McGraw-Hill Book Company

Code designations are assigned as follows:

MDDC - To declassified reports released by the Manhattan Engineer District and by the Atomic Energy Commission before March 1, 1948
AECD - To declassified reports released by the Atomic Energy Commission after February 29, 1948 (appeared in April 15, Nuclear Science Abstracts)
AECU - To unclassified reports originating within the Atomic Energy Project. (Subsequent to AECU-871, this code is applied only to reports carrying no other recognized code designation.)

Other code designations below are assigned to unclassified reports by the originating installations

Report	Abstract	Availability
AECD-3297	NSA 6-1773	J. Chem. Phys. 20, 763(1952)
AECU-1568	5-4938	Arch Biochem. Biophys. 36, 147-57(1952)
1802	6-1108	Anat. Record 111, 523-4(1952)
1830	6-1462	J. Chem. Phys. 20, 734-5(1952)
1836	6-1445	Rev. Sci. Instruments 23, 309-10(1952)
2045	6-4000	J. Chem. Phys. 20, 760-1(1952)
2074	6-4470	NSA
BMI-T-25	4-4816	Ind. Eng. Chem. 44, 1146-51(1952)
BNL-1029	6-641	Rev. Sci. Instruments 23, 264-6(1952)
1034	6-118[illegible]	J. Chem. Phys. 20, 743-4(1952)
ISC-178	NSA 5-7103	Rev. Sci. Instruments 23, 245-6(1952)
218	6-3109	Phys. Rev. 86, 1047-8(1952)
NP-1860 (p.17-24)	5-2234	Phys. Rev. 80, 850-2(1950)
NYO-3301	6-3868	Phys. Rev. 86, 1054-5(1952)
UCLA-173	6-765	J. Lab. Clin. Med. 39, 704-10(1952)
201	6-3965	Federation Proc. 11, (1952)
UCRL-1478	5-7121	Rev. Sci. Instruments 23, 306-7(1952)

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol.6, No. 6B, page "SUPPLEMENT 1".

Li	σ_a(th n) 67	osc	J. Ailloud et al., J. phys. radium 13, 171(1952).
$_6C_8^{14}$	dp(θ) C^{13}(d,p) Results of this and dn(θ) show C^{14}, N^{14} g.s. have same parity		D. A. Bromley, L. M. Goldman, Phys. Rev. 86, 790(1952).
$_7N_7^{14}$	dn(θ) C^{13}(d,n) Results of this and dp(θ) show N^{14}, C^{14} g.s. have same parity		D. A. Bromley, L. M. Goldman, Phys. Rev. 86, 790(1952).
$_{18}A_{21}^{39}$	τ 265 ± 30^y		H. Zeldes et al., Phys. Rev. 86, 811(1952). Cl(pile n).
Co	σ_a(th n) 35	osc	J. Ailloud et al., J. phys. radium 13, 171(1952).
$_{29}Cu_{35}^{64}$	$(1.34\gamma)/\beta^+ = 0.023$	a	H. T. Vlaar, A. H. W. Aten, Jr., Physica 18, 275 (1952).
Ge	σ_a(th n) 2.2	osc	J. Ailloud et al., J. phys. radium 13, 171(1952).
$_{32}Ge_{43}^{75}$	τ 42^s γ 0.15 a $\alpha = 2$		A. Flammersfeld, Z. Naturforsch. 7a, 295(1952). As(n); Ge(fast and slow n).
$_{34}Se_{43}^{77}$ 17.5^s	τ 17.5^s γ 0.162 sπ;ce$^-$ K/L = 4.6 E3 No other γ		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). Se^{76}(n,γ).
$_{34}Se_{45}^{79}$ 3.9^m	τ_1 3.5^m γ 0.096 sπ;ce$^-$ K/L = 2.9 E3		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). Se^{78}(n,γ).
$_{34}Se_{47}^{81}$ 59^m	τ_1 58^m γ 0.103 sπ;ce$^-$ K/L = 3.0 E3		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). Se^{80}(n,γ).
$_{34}Se_{47}^{81}$ 17^m	τ_2 17^m β^- 1.5 sπ No γ		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). Se^{80}(n,γ).
$_{34}Se_{49}^{83}$ 67^s	τ_1 69^s No γ		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). Se^{82}(n,γ).
$_{34}Se_{49}^{83}$ 25^m	τ_2 26^m β^- 1.5 a γ 0.176 scin 0.950 scin		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). Se^{82}(n,γ).
$_{35}Br_{46}^{80}$ 4.4^h	γ (0.049) $\alpha \geq 50$ chem		W. H. Hamill, J. A. Young, J. Chem. Phys. 20, 888(1952).
$_{42}Mo_{59}^{101}$	β^- 1.2 sπ 2.1 γ 0.191 sπ;ce$^-$ K/L~6 0.960 scin		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). Mo(n,γ).
$_{43}Tc_{58}^{101}$	β^- 1.3 sπ γ 0.307 sπ;ce$^-$ K/L~6 No other γ $(1.3\beta^-)(0.307\gamma)$		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). Mo(n,$\gamma\beta$).
$_{46}Pd_{59}^{105}$	τ 23^s γ 0.23 a $\alpha = 0.4$		A. Flammersfeld, Z. Naturforsch. 7a, 295(1952). Pd(fast n).
$_{46}Pd_{63}^{109}$?	τ 4.8^m γ 0.19 a $\alpha = 0.6$		A. Flammersfeld, Z. Naturforsch. 7a, 295(1952). Pd(fast and slow n) Ag(n); chem.
Nd	σ_a(th n) 43	osc	J. Ailloud et al., J. phys. radium 13, 171(1952).
$_{60}Nd_{87}^{147}$	τ 11.9^d β_1^- 0.384 sπ β_2^- 0.598 β_3^- 0.825 γ 0.091 sπ;ce$^-$ K/L = 4.9 0.301 0.120 0.318 0.197 0.398 0.231 0.441 0.260 0.532 0.273 E2 K/L~6 $\beta_1(0.532\gamma)$, $\beta_2(0.318\gamma)$, $\beta_3(0.091\gamma)$, $(0.091\gamma)(0.441\gamma)$		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). Nd^{146}(n,γ).

$_{60}Nd^{149}_{89}$	τ	1.8^h		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). $Nd^{148}(n,\gamma)$.
	β_1^-	0.95	sπ	
	β_2^-	1.1		
	β_3^-	1.5		
	γ	0.030	0.210	γ's by sπ; pe^-, ce^-; scin.
		0.096	K/L ~7	
		E2 K/L = 0.9	0.226	
		0.112	0.240	
		0.114	0.266	
		K/L ~5	0.424	
		0.124	0.538	
		0.188	0.650	
		0.198		
	$\beta_1(0.650\gamma)$, $\beta_2(0.210-0.266\gamma)$, $\gamma\gamma$			
$_{60}Nd^{151}_{91}$	τ	12^{m*}		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952); 85, 734A (1952). $Nd^{150}(n,\gamma)$. Parent of $27.5^h Pm$. *Formerly assigned to Pm^{151}.
	β^-	1.93	sπ	
	γ	0.085	0.421 sπ;	
		0.110	0.72 ce^-;	
		0.117	1.14 scin	
		K/L ~4		
	$(1.93\beta)(\sim 0.1\gamma)$, $(1.93\beta)(1.14\gamma)$			
$_{61}Pm^{148}_{88}$	τ	50^h		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). $Nd^{148}(n,\gamma,\beta)$.
	β^-	1.05	sπ	
	γ	0.285	sπ,ce^-	
		K/L ~8	M1	
		1.3	a	
	$(1.05\beta)(0.285\gamma)$			
$_{61}Pm^{151}_{90}$	τ	28^{h*}		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952); 85, 734A (1952). *12^mactivity previously assigned here now assigned to Nd^{151}, q.v. $Nd^{150}(n,\gamma\beta)$.
	β^-	1.1	a	
	γ	0.065	0.177	
		E2 K/L = 0.3	K/L ~9	
		0.066	0.208	
		E2 K/L = 0.2	K/L ~4	
		0.070	0.232	
		E2 K/L = 0.2	0.240	
		0.100	0.275	
		K/L ~5	0.340	
		0.116	K/L ~9	
		0.144	0.715	
		0.163		
		0.168	sπ;	
		K/L ~3	pe^-,ce^-	
$_{62}Sm^{145}_{83}$	K			W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). $Sm^{144}(n,\gamma)$.
	γ	0.061	sπ;ce^-	
		K/L = 1.0 (Pm)		
	No 0.242γ, 0.95γ			
$_{62}Sm^{151}_{89}$	τ	$>20^y$		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). $Sm^{150}(n,\gamma)$.
	No e^-			
$_{62}Sm^{153}_{91}$	τ	46^h		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). $Sm^{152}(n,\gamma)$. γ's by sπ; pe^-, ce^-.
	β^-	0.820	sπ	
	γ	0.070		
		K/L = 0.29	E2	
		0.103		
		K/L = 3.5		
		0.582		
	$(0.070\gamma)(0.103\gamma)$			
$_{62}Sm^{155}_{93}$	τ	23.5^m		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). $Sm^{154}(n,\gamma)$. γ's by sπ; pe^-, ce^-.
	β^-	1.8	sπ	
	γ	0.105		
		K/L ~4		
		0.246		
	$(1.8\beta^-)$ $(0.105\gamma)(0.246\gamma)$			
$_{63}Eu^{155}_{92}$	τ	1.7^y		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952). $Sm^{154}(n,\gamma\beta)$.
	γ	0.060	sπ;pe^-,	
		0.087	ce^-	
		K/L ~8		
		0.106		
		K/L ~8		
		0.132		
$_{73}Ta^{182}_{109}$	τ	111.2 ± 0.5^d		G. G. Eichholz, L. A. Ficko, Phys. Rev. 86, 794(1952). Ta(pile n).
$_{79}Au^{192}_{113}$	τ	4.13^h		R. W. Fink, E. O. Wiig, J. Am. Chem. Soc. 74, 2457(1952).
	d 5.7^h Hg			
Hg	σ_a(th n)	354	osc	J. Ailloud et al., J. phys. radium 13, 171(1952).
$_{80}Hg^{\leq 191}_{\leq 111}$	τ	2.0^h		R. W. Fink, E. O. Wiig, J. Am. Chem. Soc. 74, 2457(1952). Au(96-Mev p); chem.
$_{80}Hg^{192}_{112}$	τ	5.7^h		R. W. Fink, E. O. Wiig, J. Am. Chem. Soc. 74, 2457(1952). Pt(36-Mev α); chem. Au(60-Mev p); chem.
	β^+	1.16	a,s	
	ce^-	0.18	s	
	γ	1.39	a	
	parent of 4.0^hAu			
$_{80}Hg^{193}_{113}$	τ	10^h		R. W. Fink, E. O. Wiig, J. Am. Chem. Soc. 74, 2457(1952). Au(55-Mev p); chem.
	No β^+			
	K x rays			
	parent of 15.8^hAu			
$_{80}Hg^{194}_{114}$	Not produced by Pt(36 Mev α) Au(35-to 96-Mev p)			R. W. Fink, E. O. Wiig, J. Am. Chem. Soc. 74, 2457(1952); J. H. Moon, A. L. Thompson, Phys. Rev. 83, 892A (1951).
	39.5^h Au^{194} not found			
$_{80}Hg^{195}_{115}$	τ	31^h		R. W. Fink, E. O. Wiig, J. Am. Chem. Soc. 74, 2457(1952). Au(30-Mev p); chem.
	No β^+		s	
	K x rays		a	
$_{82}Pb^{210}_{128}$	Energy of >90% of β^- is <5 kev		aβe^-	J. Teillac et al., J. phys. radium 13, 143(1952).
$_{82}Pb^{210}_{128}$	γ	7.8 kev	pc	S. G. Cohen, A. A. Jaffe, Phys. Rev. 86, 800(1952). *Relative intensities.
	L x rays			
	α_1 100%*	10.8 kev	pc	
	β_4	13.0 kev		
	γ_1 10%*	15.3 kev		
	No $L_I - L_{II}N$ transitions			

$_{85}At^{211}_{126}$	α	5.85	ic	F. F. Momyer et al., Phys. Rev. 86, 805 (1952).
$_{86}Rn^{209}_{123}$	τ	31^m		F. F. Momyer et al., Phys. Rev. 86, 805 (1952).
	K ~85%			
	α ~15%	6.02	ic	Th(340-Mev p).
$_{86}Rn^{210}_{124}$	τ	2.7^h		F. F. Momyer et al., Phys. Rev. 86, 805 (1952).
	K ~10%			
	α ~90%	6.02	ic	Th(340-Mev p).
$_{86}Rn^{211}_{125}$	τ	16^h		F. F. Momyer et al., Phys. Rev. 86, 805 (1952).
	K 74%			
	α 26%	5.82	ic	Th(340-Mev p).
$_{86}Rn^{212}_{126}$	τ	23^m		F. F. Momyer et al., Phys. Rev. 86, 805 (1952).
	K <1%			
	α >99%	6.23	ic	Th(340-Mev p).
$_{86}Rn^{215}_{129}$	α	8.6	ic	W. W. Meinke et al., Phys. Rev. 85, 429 (1952).
$_{86}Rn^{221}_{135}$	τ	24^m		F. F. Momyer et al., Phys. Rev. 86, 805 (1952).
	β^- ~75%			
	α ~25%			Th(100-Mev p).
$_{87}Fr^{<211}_{<124}$	τ	$<5^m$		F. F. Momyer et al., Phys. Rev. 86, 805 (1952).
	for all isotopes <211			
$_{87}Fr^{211}_{124}$	τ	2 to 5^m		F. F. Momyer et al., Phys. Rev. 86, 805 (1952).
	K/α large			
$_{87}Fr^{213}_{126}$	α	6.36	ic	F. F. Momyer et al., Phys. Rev. 86, 805 (1952).
$_{87}Fr^{213}_{126}$	τ	$<5^m$		F. F. Momyer et al., Phys. Rev. 86, 805 (1952).
$_{88}Ra^{213}_{125}$	τ	$\sim 2^m$		F. F. Momyer et al., Phys. Rev. 86, 805 (1952).
	α			
$_{88}Ra^{219}_{131}$	α	8.0	ic	W. W. Meinke et al., Phys. Rev. 85, 429 (1952).
$_{89}Ac^{222}_{133}$	τ	5.5^s		W. W. Meinke et al., Phys. Rev. 85, 429 (1952).
	d 1.8^m Pa			
$_{90}Th^{229}_{133}$	α	7.55	ic	W. W. Meinke et al., Phys. Rev. 85, 429 (1952).
$_{90}Th^{233}_{143}$	τ	23.6^m		W. C. Rutledge et al., Phys. Rev. 86, 775 (1952).
	β^-	1.23	a	$Th^{232}(n,\gamma)$.
	No γ, no e^-			
$_{92}U^{227}_{135}$	τ	1.3^m		W. W. Meinke et al., Phys. Rev. 85, 429 (1952).
	α	6.8	ic	
$_{95}Am^{241}_{146}$	γ 7.5%*	0.0263	pc	J. K. Beling et al., Phys. Rev. 86, 797 (1952).
	100%*	0.0597		$Pu^{239}(n,\gamma;\ n,\gamma\beta)$.
	~0.5%*	0.075 ?		*Relative intensities of photons.
	$(0.059\gamma)/\alpha = 0.40$		scin	
	$\alpha\gamma$			
	Np L x rays			